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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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BRITISH CAST IRON RESEARCH ASSOCIATION.

The Registered Office and Laboratories of the B.C.I.R.A. are at :—

24, ST. PAUL'S SQUARE, BIRMINGHAM.

Telephone: Central 1885. Telegrams: CIRA.

The B.C.I.R.A. Scottish Laboratories are :—

Foundry Technical Institute, Meek's Road, Falkirk *(Telephone 332)*

Forthcoming Events.

JANUARY 21.

Society of Chemical Industry (Birmingham and Midland Section) :—Ordinary meeting. "Chrome Plating," Paper by E. J. Dobbs.

JANUARY 23.

Institution of Welding Engineers :—Ordinary meeting at Birmingham. "Modern Improvements in Resistance Welding Machines," Paper by C. A. Hadley.

Institute of British Foundrymen.

JANUARY 16.

London Branch :—Ordinary meeting in London. "High-Duty Grey Cast Iron," Paper by A. E. MacRae Smith.

JANUARY 25.

Lancashire Branch (Junior Section) :—Ordinary meeting at Manchester. "Foundry Costing," Paper by J. O. Gray.

East Midlands Branch :—Annual meeting at Loughborough. Short Paper competition.

Institute of Industrial Administration.

We have received from the Institute of Industrial Administration its examination scheme for its Diploma of Industrial Administration, and admit, *ab initio*, that we have never seen a syllabus which so adequately covers the requirements of the managers of industrial enterprises. Though this Institute has been established since 1922, we confess that we had never heard of this organisation until the receipt of its syllabus. Mr. A. S. Comyns Carr, K.C., is the president, and amongst its vice-presidents there are the names of Sir Kynaston Studd, Bart., the ex-Lord Mayor of London, and chairman of the London Polytechnical School; Sir John E. Thornycroft, Mr. Sam Mavor, Mr. Arthur Pugh and Mr. J. Maughfling (president of the Society of Motor Manufacturers and Traders). The diploma they give is A.I.I.A. Again, we have not met anyone using these letters.

We have on previous occasions stated that when a technically-trained man achieves a really important position, his thought-output only includes from 1 to 5 per cent. of the knowledge gained during his technical training, and his success depends upon the efficiency of the other 95 to 99 per cent. The composition of this major portion is largely, though not entirely, covered by the excellent syllabus drawn up by this Institute. We wish to encourage the work of this Institute and in order to do so we make the following proposals:—Primarily, the Institute must receive Governmental recognition in some form or other. The curriculum of the London School of Economics, for instance, takes care of a certain portion of the syllabus, and it or an analogous body could possibly expand to cover the entire field exposed. Again, its syllabus should be compared with the Bachelor of Commerce degree course of the London University, and ascertain if the latter is definitely inadequate, or where orientation could be effected so that intending employers would be convinced that something of outstanding value was implied by degree or diploma. Secondly, in these democratic days, every town and village thinks to emulate the standard of Universities, and, naturally, would wish to train students for so desirable a diploma. But, we ask, is the atmosphere of the provincial and small town technical school sufficiently enlightened to conduct "a complete system of study for those who seek to fit themselves for those '£10,000 a year jobs,' and for positions leading up to them," to quote some publicity matter received from the Institute? Thus we suggest the subject must be confined to the University cities, and we feel bound to advocate that, admirable though their council's plans may be, the Institute must co-operate with either the Government or one or more of the learned societies.

Blast-Furnace Practice.

We give elsewhere in this issue a review of the concluding volume of Mr. Clements' three-volume work on Blast-Furnace Practice. We have not hesitated to express in reviews of the previous volumes the indebtedness of the industry to author and publisher alike. It is a well-known and regrettable fact that the output of first-class technical and scientific works—other than mere text-books—is small because the circulation is often limited to a comparatively narrow group of specialists, and the remuneration of the author and the reward of the publisher are alike inadequate. Where such books are concerned, too, the people who are really capable of writing them often lack time to do anything of the sort, and the reading public is fobbed off with the eminently unsatisfactory compilations of hack writers. After all, the specialist is worthy of his hire, and it is not sufficient to stress the reputation that will accrue to him as the author of a standard work. Reputation, for instance, will hardly pay him for the expenses incurred in the preparation of his book. Some of our most notable specialists are quite unknown to students and even to members of the great technical societies. Nor are they encouraged to give to the world work which has literally taken years of their life, for remuneration no higher than that obtained by the skilful hack writer. There is at the moment altogether insufficient differentiation, whether financial or of esteem, between original work and someone else's account of it.

Some of these considerations may have been in the mind of the publishers in fixing a price of nine guineas for the work under discussion. They may fairly argue that people who must have the book—operators, engineers, and draughtsmen alike—will not grudge the price, and they are probably right. It is infinitely preferable to pay nine guineas for a good book than a fifth of the price for a poor one. But while we recognise and sympathise with this point of view, we deplore its necessity, for it makes the book practically prohibitive to the very class that need it most, namely, the students. Such a work may, after all, very well form a sort of datum line of present knowledge—a student who can pass an examination based on it will certainly be acquainted with the main features of modern blast-furnace prac-

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tice. Research programmes may equally well be based on this work as a summary of existing knowledge.

We hope, therefore, that this will be the forerunner of a series of works, such, for instance, as on rolling-mill practice, open-hearth and general furnace practice (on which no one would be more competent to write than Mr. Clements himself), and even on foundry practice. For while we have several excellent books on the metallurgy of cast iron, and on equipment and operation, such as those by Hatfield, Hurst and Rawlinson, there is considerable need for an up-to-date survey of modern cast-iron metallurgy and foundry operation as a whole.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Coal Dust.

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I have read with interest the recent articles upon the uses and actions of coal dust in moulding sands, which, in my opinion, are inclined to lead the reader into believing that coal dust is a very mysterious and uncertain material. Whilst fully appreciating the efforts of some experimenters, I am afraid that the novelty of witnessing certain phenomena in a mica-windowed mould has played upon their imagination. Surely after all these years of practice there is little mystery respecting the functioning of coal dust?

The one simple action of coal dust, so far as its advantages in moulding sand are concerned, is to deposit a carbon film on the surface of the mould. This is caused by combustion through contact with the molten metal. Such theories as "a protective layer of gas," etc., are not logical. How is it possible for a "layer of gas" to remain between the sand and metal, when the permeability of the sand (apart from vents) allows for the immediate escape of gases under pressure of the molten metal?

In respect to the use of coal dust, it is not absolutely essential, but, like many other materials, "it pays to use it." It is what I would term a "safety material." To give a simile:—A cook adds salt when boiling potatoes, yet, in many cases, there is still more salt added at the table to suit various palates. If the cook omitted the salt when boiling the potatoes, they would not be very palatable to many, even though salt is added at the table. We can liken the cook's salt to the coal dust in moulding sand. The further additions at the table may be likened to facing materials such as blackings, plumbago, etc. Now the sand which contains coal dust may be suitable for many jobs without the extra facing, but if the sand did not contain even the coal dust there may be much trouble. The extra facing then may be reserved for better-class work, as the table salt is ready for those who like more salt than the cook adds when boiling the potatoes.

Coal dust is a material which "automatically" deposits a fine film of carbon on those sand grains in the immediate vicinity of the molten metal, and thus minimises "burning-on." In many cases this fine coating of carbon is sufficient for the purpose and, therefore, the use of a facing material is not necessary. This is the economical feature of coal dust. The amount of coal dust actually decomposed when a mould is poured is far less than the amount of blacking or other facing material which would otherwise have to be applied to the face of that particular type of mould to get similar results.

The amount of unburnt coal dust remaining in the sand after casting renders the greater part of it (with, of course, additions of new sand or synthetic bond to strengthen it) again usable with safety.

To what advantage coal dust can be, depends upon the quality of the sand. I know of large and important foundries who use coal dust and never use blackings or other facings. I also know others who do not buy coal dust, but use only blacking (even to the mixing of it in the sand), yet all these people are turning out good work on an economical footing.

I read that one gentleman contended that there was only one grade, namely, superfine, of coal dust essential, and (for its specific purpose) I am entirely in agreement with him.

Some founders say, "I must have a coarse grade for the large and heavy work I do," but this is not necessary, in fact, it is bad practice. Their reasons for requiring a coarse grade is for the coal dust to act as an "opening" material for sand which is really of too close a texture for the heavy work. It would be far better, both economically and in results achieved, to use a coarser sand and superfine coal dust, and the better the sand the less coal dust required. I have seen large work cast in Belgian green sand which contained a minimum amount of superfine coal dust, and this work had hitherto been made in strong compo, which was stoved and tarred. But the Belgian sand was highly refractory and strong in bond and, therefore, withstood the weight and temperature. It was so infusible that only a minimum of coal dust was added, and in this case it was more for safety than actual necessity.

Coal dust of high volatile and carbon contents and low in ash in sulphur is undoubtedly the finest "safety material" in the foundry.—Yours faithfully,

GEORGE FORRESTER.

"Glen Meay,"
Tapton View Road,
Chesterfield.

January 14, 1930.

Calendars, Diaries, Etc., Received.

We have received from Atham Collieries (1924), Limited, Accrington, a monthly tear-off wall calendar; from H. Hendra & Son, Townend Road, Wandsworth, London, S.W.6, a monthly tear-off wall calendar; from Stephenson Clarke & Associated Companies, Limited, 4, Saint Dunstan's Alley, London, E.C.3, a monthly tear-off wall calendar; from Sir W. G. Armstrong Whitworth & Company (Engineers), Limited, Newcastle-upon-Tyne, a three months to the page monthly tear-off wall calendar; from Wm. Cumming & Company, Limited, Kelvinvale Mills, Maryhill, Glasgow, a desk calendar; from the Stanton Ironworks Company, Limited, Notts, a week to the page diary containing much useful technical data; from Watsons (Metallurgists), Limited, Lancaster Street, Sheffield, a week to the page diary; from the Staveley Coal & Iron Company, Limited, Chesterfield, a combination diary and pocket wallet, together with an inset carrying much useful technical data; from Mr. R. A. Miles, the Manchester representative of the Stanton Ironworks Company, Limited, 10, Deansgate, Manchester, a vest pocket diary; from the British & Continental Traders, Limited, Astor House, Aldwych, London, W.C.2, a four days to the page diary containing data of special interest to foundrymen; from Crossley Brothers, Openshaw, Manchester, a monthly tear-off wall calendar; from H. G. Sommerfield, Limited, a desk appointment diary; from Crofts, Limited, Bradford, a monthly tear-off wall calendar; from T. L. Hall (Tipton), Limited, a daily tear-off wall calendar; from Hobbies, Limited, Dereham, Norfolk, a pocket wallet; from B. T. King, 146, Queen Victoria Street, London, E.C.4, a two day to the page pocket diary; from Martha Simm & Sons, a daily tear-off calendar, adapted for either wall or desk use, and from the United Steel Companies, Limited, Sheffield, a tear-off desk engagment diary, with a week to the page.

Random Shots.

I saw a note elsewhere in these columns a week or so ago to the effect that "it is becoming increasingly common to transport powdered fuel in specially designed wagons to the steelworks and foundries" . . . in Germany, be it understood . . . "for immediate use." This reminds me of the fact that when we were all in Germany last autumn I actually saw some such wagons—or that, at least, was what I was told they were. I daresay you will remember them—upright containers, somewhat barrel-like in shape, carried on trucks, and admirably presented for our inspection on account of the flat nature of the countryside. I remember watching these curious monsters slowly approach the level crossing at which we were waiting, what time I wondered idly what they were, until some informative person pointed them out as carriers for pulverised fuel. Makes you feel highly adventurous, that sort of thing. Fancy having seen them three months before they achieved notice in print!

* * *

You have probably noticed the care with which I avoid the controversial. At times like that of the Election my attitude was as broad—I was going to say as catholic, but it might look like a bad pun if I did—as that of the Irishman who had a scrap going on and inquired: "Is this a private fight, or can anyone join in?" In other words, I did record my vote, but I fancy my readers would be hard put to it to say how! However, I don't think it can any longer be regarded as controversial to talk about Russia, anent my references last week. It took me, as a matter of fact, quite a long time to realise what "U.S.S.R." meant, and even now I am mixed up between the English and the French versions, and I don't know whether it is "U.S.S.R." or "U.S.R.S.," and whether it is Socialist Soviet or Soviet Socialist. (Do you remember the howler of the small boy who described a soviet as something a waiter carried on his arm?) But I notice that the alarming initials are beginning to appear in quite familiar situations, such as in a list of wireless wavelengths. And I did hear a rumour, though I can't give chapter and verse for it, that certain Government departments had circularised all the organisations with whom they have dealings, requesting the use of the new name when necessary.

* * *

I don't know whether to claim prophetic powers, or something less pretentious, but when I inveighed against the setting of the C.I.R.A. lunch in November I didn't realise how effectively the Fates would move on my side. I've never had anything against the Hotel Cecil except the "décor" of its "Indian Suite," so-called, but in the future I am not likely to have even that against it, since the building has been purchased for office use, as you have doubtless seen. I wonder what will happen to half the Americans who visit London? They always seem especially fond of the Strand. As a matter of fact I once read somewhere that the Strand is as cosmopolitan as any street in London, and that is saying a bit. I don't know that it had ever struck me that way, but I daresay it is something of a highway to the foreigners who come to London—newspaper people, students, American visitors, sailors—though you have to go down towards the Docks to get the real cosmopolitan tang.

* * *

Not that I want to be cosmopolitan at this time of year! There's nothing like being English and in England just now if you happen to like a good fire!

MARKSMAN.

Process Control and Stop-Watches.

When a representative of Messrs. A. Arnold & Company, of 17, Elmcroft Avenue, Golders Green, N.W.11, brought to our notice a line of stop-watches specially designed for the engineering industry, we were impressed with the possibilities of great utility of such instruments, especially if they were cheap. This last factor

FIG. 1.

seldom concerns the editorial side of technical journalism, but in this case it is of first-rate importance because it gives the executive a chance of placing in the hands of every foreman and charge-hand a tool which is just as important under modern industrial conditions as a

FIG. 2.

foot rule. If a foreman or charge-hand makes some slight alteration in the working of a machine he should be in a position accurately to measure the effect of time-saving himself without reference to an executive officer. That the engineering aspect of stop-watches has been

FIG. 3.

thoroughly realised by the firm is shown by the fact that three models have been placed on the market. They are illustrated in Figs. 1 to 3. Fig. 1—a 30-hr. watch—is the cheapest, and is fitted with a lever movement. The centre seconds-hand makes one revolution a minute over a scale graduated in fifths of a second. It is stopped and started by a small projection on the periphery. This model does not possess a fly-back arrangement. Fig. 2 is more expensive but still very cheap. It has minute- and second-hands only, but possesses start, stop, and fly-back actions. Fig. 3 shows a still better and more expensive watch having 15-jewelled lever mechanism. In addition to the ordinary hour and minute hands, stop-watch minute, seconds and fifth-seconds hands are provided, these being stopped, started and reset to zero independently. As we have stressed that the price of these stop-watches does permit of a greater extension of their use than heretofore, we feel we might state that the price of the cheapest is only 90s. a dozen.

Whilst chatting with the representative of Messrs. Arnold we were shown an "engagement alarm watch," which has potentialities in the conduct of research and control of operations. Sometimes in the control of process, something requires personal supervision at a certain moment. If one possesses such a watch one can concentrate on business of an entirely different kind in the interim with every assurance that the essential control will not be neglected.

Penton Gold Medal awarded to Mr. H. A. Schwartz.

Mr. H. A. Schwartz, research manager to the National Malleable & Steel Castings Company, Cleveland, has been selected to receive the 1930 major award of the American Foundrymen's Association, the John A. Penton Gold Medal. This award, which is made to Mr. Schwartz for his outstanding contributions to the foundry industry, has been approved by the Board of Awards and will be presented to him at the 1930 convention the week of May 12. Mr. Schwartz is especially noted for his many contributions to the field of research on malleable iron. He has been closely identified with the A.F.A. for many years as a contributor of Papers, as a member and chairman of various committees and as chairman of convention sessions. One of his Papers was the 1928 A.F.A. exchange Paper to the Association Technique de Fonderie de France. At present he is chairman of two important committees of the malleable division, namely, those on specifications and on recommended foundry practices. He also represents the A.F.A. on Committee A-7 of the A.S.T.M. on malleable iron and on the ferrous metals committee advisory to the U.S. Bureau of Standards.

In addition to his membership in the A.F.A., Mr. Schwartz is a member of the American Society of Mechanical Engineers, American Society for Testing Materials, Society of Automotive Engineers, American Institute of Mining and Metallurgical Engineers—serving as vice-chairman of the Northern Ohio Chapter in 1924-1925—the American Society for Steel Treating, the Iron and Steel Institute, the American Chemical Society, the Research Committee of the Malleable Iron Research Institute and the Cleveland Engineering Society.

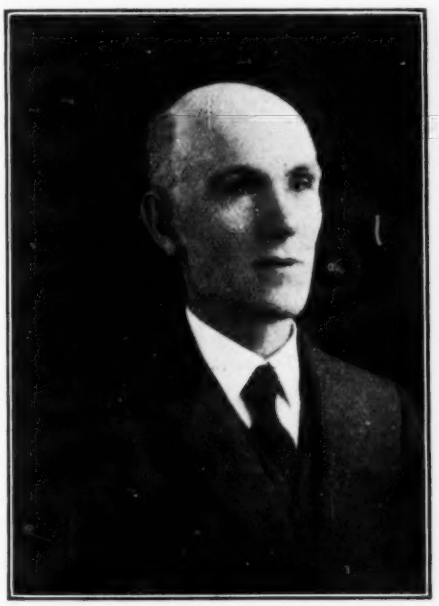
Mr. Schwartz is the author of the outstanding book on malleable iron, the first edition of "American Malleable Cast Iron" being published in 1922. In addition to his contributions to A.F.A. sessions, he has presented numerous Papers before meetings of the A.S.S.T., A.I.M.E., S.A.E., American Ceramic Society, American Welding Society, World Engineering Congress held at Tokio, Japan, in 1929, and to the technical press. His technical training was obtained at Rose Polytechnic Institute, Terre Haute, Ind., where he received three degrees, Bachelor of Science in 1901, Master of Science in 1903 and Mechanical Engineer in 1905.

I.B.F. Branch Presidents—No. 5.

WALES AND MONMOUTHSHIRE BRANCH.

Mr. W. S. Kinsman, was born at Cardiff in 1885, commenced his foundry career in 1900, serving his apprenticeship with one of the late Presidents of the Institute, Mr. Charles Jones, of the Ninian Foundry, Cardiff. Following this, he was employed by Messrs. John Williams & Sons (Cardiff), Limited, East Moors, founders and iron and steel merchants for 4½ years.

In 1911 he went to Canada with the purpose of widening his knowledge and experience of different foundry methods. He was employed by the Algoma Iron & Steel Works, Sault St. Marie, Ontario, and worked later at Montreal, returning to England in November, 1913, when



MR. W. S. KINSMAN.

he again joined Messrs. John Williams & Sons (Cardiff), Limited.

During the war he followed his foundry work and devoted all his spare time to the Red Cross. Later, he took up a foundry course of instruction with the International Correspondence Schools and obtained a diploma. In 1921 his late foreman, Mr. William Rees, retired, and Mr. Kinsman was appointed to the position; he has since installed several improvements in machinery.

He takes a keen interest in welfare work, being a secretary of the Works Welfare Scheme.

Uneven Stock Descent in Blast Furnace.—For a number of years the North Central Experimental Station of the U.S. Bureau of Mines, in co-operation with the University of Minnesota, has been studying blast-furnace problems in the laboratory and at the works. Recent measurements of the rate of stock descent in various portions of a blast furnace have verified the prediction made several years ago that localised combustion at the tuyeres of a blast furnace results in faster movement of stock along the periphery. As hearth diameters are increased and changes in lines made toward a cylindrical shape, the departure from the counter current movement of gas and solid will become greater. On the basis that the zone of greatest activity with respect to gas flow and stock movement extends over an annular ring 4 ft. wide, about 28 per cent. of the hearth area in a 17-ft. hearth furnace and about 50 per cent. in a furnace with a diameter of 27 ft., are relatively inactive. This relatively inactive central area causes slower travel of stock in the central part of the furnace.

XUM

Scientific Foundry Work.*

By Wesley Lambert (President of the Institute of British Foundrymen).

Recently, in connection with a batch of defective castings, an incident arose which necessitated a report being submitted to a firm of Inspecting Engineers. The concluding sentence of that report was a statement which may be regarded as an aphorism—"The founding of metals into complicated shapes is not a simple mechanical engineering process, nor can the making of castings ever become an exact science."

It would be difficult, perhaps, to find an experienced foundryman who does not wholeheartedly endorse at least the first portion of the foregoing statement. Unfortunately, however, it is an undeniable truth that engineers and buyers, and even some foundry proprietors, fail to recognise the true significance of the facts as set forth in the above statement, and such individuals are prone to regard each and every defective casting as being due either to gross carelessness on the part of the foundry or lack of scientific control on the part of the foundry metallurgist. The sooner the engineer, the buyer and the foundry proprietor become enlightened as to how far the art of founding metals is removed from an exact science and that founding is not strictly comparable with a mechanical engineering process, the better for all parties concerned.

What Constitutes Science.

Theory may be regarded as affording a possible explanation of a happening as apart from actual demonstration; science as being exact knowledge grounded on practical demonstration. It has been said of this definition of science that the obverse would present the matter with not less force and, perhaps, in a manner more easily comprehended, "Science is a demonstration grounded on exact knowledge." If we accept this latter definition of science, it at once becomes obvious that, by reason of the impossibility of acquiring an exact knowledge of what happens when molten metal is teemed into and solidifies in foundry moulds—moulds of various sizes and of every conceivable shape and fashion—it is hopeless ever to expect the making of castings to become an exact science. Only by constant striving to instil this fact into the mind of the layman can it be expected that some consideration on his part will be forthcoming of the difficulties experienced by foundry craftsmen. No brief can be held for the defence of either the slipshod or the self-centred, no-use-for-science foundry craftsman. To quote from the preface of a small primer published some time ago—"A popular fallacy must, as far as possible, be exploded, namely, that science and practice are antagonistic." If the truth of so-called science cannot be proved in practice, the alleged "science" is misnamed. The most successful foundry craftsman is he who is conforming most to scientific requirements; were it not so, success could not have been attained. "When the skilled worker embraces science he becomes a scientific craftsman." Science is always advancing, and thereby tending towards the expansion of the arts and crafts, and this progressive march must continue. The old must give way to the new until "imagination, inspiration and initiative" are no more. As Mark Twain has so succinctly expressed this fact—"The altar cloths of to-day are the door-mats of to-morrow."

Importance of Planning.

Co-ordination of science with practice, co-operation between the works metallurgist and the foundry craftsman, and the production thereby of a good article, should be the aim and object of every foundryman and foundry metallurgist. The metallurgist must proclaim his indebtedness to the skill of the craftsman, and the foundryman on his part must freely acknowledge the guidance of the metallurgist. Much of the present day "stumbling and groping in the dark" in the foundry industry can be overcome by the light of science, by mutual trust and the interchange of ideas between the foundryman and the metallurgist, and by careful planning on the part of both. "Plan your work and work your plan" is the admitted slogan adopted by one of the most successful organisers in America. The spirit of this slogan merits adoption in many foundries of to-day. The truth is often unpalatable, and the fact that many foundries—more particularly those unconnected with any engineering department under the same proprietorship—are hard put to it to command a reasonable profit on turnover, is an unpalatable though accepted fact known to everyone intimately connected with the foundry trade in Great Britain. Acceptance of such a fact and of the state of affairs which has led up to this condition of things must not be allowed, however, to engender apathy on the part of either the foundry proprietor or the foundry worker. Placid resignation to such a state of things is neither cricket nor British. Many apparently hopeless situations have been saved and brought to a successful and profitable issue by the application of initiative, reorganisation and careful planning. The history of warfare, diplomacy, industry and sport, and of many other efforts of mankind abounds with instances of apparently hopeless failures culminating in glorious successes, due to careful planning and the carrying out of well-matured schemes. To particularise in the direction in which we, as members of an Institute representing a splendid craft, are most interested at the moment, namely, the well-being of the foundry industry generally, but more particularly so in Great Britain, it is a justly conceded fact that the foundry craftsmen of this country, as craftsmen, are equal in all respects to their *confrères* in any other country, and therefore if a hearty co-operative effort between the proprietors and workers is forthcoming, that measure of success to which the foundry industry in any other country has attained, and moreover that any other nation is desirous of attaining, can surely equally well be secured in this country by careful planning in the future. The reciprocal interchange of ideas by means of exchange "papers" with the foundry workers abroad is not only a generous acknowledgment of the position of the foundry craft in other manufacturing countries, but is a wise adoption, tending as it does to disrupt that self-centred conservatism which of itself will eventually leave one struggling to maintain even an equality of production. But interchange of ideas amongst ourselves in this country is even more desirable, and it is on this account alone we may take pride in the number and quality of the papers read at the various branch meetings of our Institute.

Planning, in relation to foundry production, is to be understood to include the selection of personnel, revision of foundry lay-out, the introduction of a sound costing system, and a stricter classification of output. Out-of-date and defective plant still functions, mischievous relics of exploded theories and unsound costing methods still hold sway in many foundries.

Industrial Misfits.

As regards the point—"A stricter classification of output"—of which mention has just been made, I crave indulgence in submitting my personal views on this subject. There is to-day, and will be always, a demand for the best of everything, as well as a market for the cheap article. The West End Saville Row tailor is not in competition with the East End clothier, and neither suffers materially as a result of the legitimate business activities of the other, notwithstanding that both establishments are engaged in the same line of business. Likewise, in the foundry trade there is a demand for highly specialised, high-duty castings, for which the customer is prepared to pay an enhanced price for a thoroughly reliable casting—castings that may be likened, in my analogy of the clothing establishments, as the Saville Row type of product. In using the word "cheap" in the second category of product, let there be no misunderstanding as to the quality of the article. It is not suggested that a single foundry in Great Britain or elsewhere should demean itself by manufacturing castings "to shape only" or which the purchaser can describe as merely "cheap and nasty." An article can be both cheap and good at the price paid for it, and thereby prove itself in truth to merit the description of "good value for money." It is my personal opinion that it is extremely doubtful whether, unless the lay-out has been specially designed, true economic working can be effected in any foundry attempting to turn out both classes of castings to which reference has been made. Too often disaster arises through a comparative poorly equipped foundry—poor not only in its mechanical equipment, but also in the ability and experience of its personnel—attempting work of a class much beyond its normal product, and thus converting what would most probably have been profitable business for an outside neighbouring foundry into an internal loss, which eats up the profits earned by the legitimate routine products for which the foundry may well be suited. I hold it to be a duty of the foundry management to endeavour to the utmost to make a profit from its own legitimate products rather than to "chase the hare" to the detriment both of its own foundry business and that of others.

Internal Co-operation.

The foregoing remarks are not to be interpreted as in any way discouraging to honourable ambitions, but I submit as an honest opinion that that management is wise which has planned to turn down inquiries for castings, the nature of which is such as not to offer a prospect of a reasonable profit by virtue of the foundry equipment and experience not being equal to the job. To put the foundry trade in a prosperous condition, orders must be forthcoming and reasonable profits must be made as far as possible on every job undertaken. Only the minimum amount of "adventurous" work should be undertaken until the results on such work warrant the taking of further orders on which a reasonable profit by virtue of the foundry should be committed to much haphazard adventurous work at the direct expense of the profits from routine work. When speaking of routine work, I do not mean necessarily the turning out of castings of uniform design and weight or even mass production work, but refer rather to that class of casting well within the productive capacity of the foundry. I would emphasise further the desirability that every new design of casting which departs materially from any of those previously successfully made in the foundry should receive separate consideration. The time has gone when, as often happened in the past, a pattern was dumped in front of a craftsman with the all too brief intimation—"Thirty off this Joe." Let the foundry manager or foreman adopt the slogan cited, and plan the procedure to be taken in conference with the moulder, core maker, etc. Many "wasters" can thus be saved and economy effected.

* An address given to the Scottish Branch of the Institute of British Foundrymen at Glasgow.

Alloys Now Cast in Great Britain.

By Thomas Henry Turner, M.Sc.

(*Continued from page* 462, *column* 41.)

White Metals.

The relatively low melting-point white-metal alloys are used in many industries and in great variety of compositions. Anti-friction alloys, printing metals, die-casting alloys and solders form the principal groupings of such alloys. Several tables have therefore been compiled from the data obtained, to show alloys of these types known to be in use at the present time.

It will be noted that copper is generally present in anti-friction metal, but not in printers' metals, except in the case of "Founders' Type." In all other printers' metals, copper is regarded as an undesirable impurity which is liable to clog the nozzles of the type-casting machines. The really astonishing differences in the compositions of these alloys are due, nominally, to variations in working speeds and loads for similar classes. Greater knowledge of the engineering requirements and metallurgical fundamentals will probably lead to simplification, by eliminating certain alloys in favour of other standardised alloys of approximately similar compositions and properties.

The writer has no knowledge of any B.E.S.A. standards for bearing metals, but he may state that the *British Admiralty Whitemetal* is specified as:—Sb 8 to 9, Cu 7 to 2 per cent., and remainder Sn; being normally Sb 9, Cu 7, and Sn 84 per cent.

Admiralty Underwater Metal contains zinc,, and is:—Zn 29, Cu 1, and Sn 70 per cent.; and a less used white-metal known as "B" is:—Sb 9, Cu 6, and Sn 85 per cent.

TABLE XVII.—*Some Purposes for which Anti-Friction Alloys are Cast. (Cf. Tables XVIII and XIX.)*

1. Agricultural machinery.
2. Air compressors.
3. Aircraft engines.
4. Explosion engines (Diesel)
5. ,, ,, (motor car).
6. ,, ,, (lorries).
7. ,, ,, (oil and gas)
8. Steam engines (high speed or hydraulic power).
9. ,, ,, (medium speed and medium power).
10. ,, ,, (medium or low speed and low power).
11. Steam turbines.
12. Dynamos (large).
13. ,, (medium or small)
14. Electric motors (large).
15. ,, ,, (medium or small)
16. Tramcar axleboxes.
17. Tramcar armature bearings.
18. Centrifugal pumps.
19. Concrete mixers.
20. Stone crushers.
21. Lifts (electric).
22. Line shafting.
23. Rolling mills.
24. Stern tubes and outer brackets.
25. (Marine steam engines, cross-head connecting rod and main bearings).
26. Trawler engines—all bearings.
27. Fans and ventilators.
28. Sugar machinery.
29. Locomotive bearings (all).
30. Railway carriage bearings.
31. Railway wagon bearings.
32. Metallic packing rings.
33. Admiralty work.

The alloys used for these purposes will be found by comparison with Tables XVIII and XIX.

TABLE XVIII.—*Anti-Friction Metals with more than 50 per cent. Sn.*

(Cf. Tables XVII and XIX.)

Composition per cent.				Uses for which these bearing alloys are cast.
Sn.	Sb.	Pv.	Cu.	
93	3.5	—	3.5	2, 3, 4, 5, 11, 25.
88	8	0.5 Bi.	3.5	12.
86	11	—	3	3, 5, 8, 11 25.
86	9.5	0.5	4	3.
85	9	—	6	33.
85	8.5	1.5	5	3, 4, 5, 13.
84	9	—	7	33.
84	8	—	8	23.
82	11	6	1	31.
82	11	1	6	30.
81.5	10.5	2.5	5.5	29
80.5	8.5	6.5	4.5	25.
80	12	1	7	2, 7, 11, 12, 14, 29.
80	10	7	3	5. 7, 11, 23.
78	10	2	10	25, 29.
77	3	17	3	25.
76	10	8	6	17.
75	12	7	6	8, 25.
75	10	6	9	5, 7.
74	7	14	5	25.
70	—	29 Zn.	1	33.
64	11	22	3	6, 9, 10, 11, 12, 13, 25
60	12	25	3	6, 7, 12, 13, 14, 15, 18, 23, 24, 25, 29.
60	12	22	6	31.
60	10	28	2	8, 29, 30, 31.
60	—	38 Zn.	2	24.
52	10.5	33	4.5	5, 7, 12, 13, 9

TABLE XIX.—*Anti-Friction Metals with less than 50 per cent. Sn. (Cf. Tables XVII and XVIII).*

Composition per cent.				Uses for which these bearing alloys are cast.
Sn.	Sb.	Pb.	Cu.	
48.5	10	40.5	1	26.
47.5	10	41.5	1	30.
45	13	38	2	7, 9, 11, 13, 15, 16, 21, 23, 26, 29.
40	10	48.5	1.5	6, 15, 16, 18, 20, 23, 25.
40	10	48	2	31.
35	12	52	1	17.
26	15	57	2	10, 12 13.
20	17	63	—	27, 28.
20	16	63	1	30.
20	15	65	—	10, 16, 17.
20	15	64.25	0.75	13, 27,28, 30, 31.
18	14	67.5	0.5	16, 30, 31.
11	15	74	—	1, 19, 20, 21, 22, 31.
10	15	74.5	0.5	1, 27, 28.
10	—	90 Zn.	—	20.
7	12	79	2	1, 18, 19, 20, 30, 31.
5	15	80	—	20, 21, 22, 28.
5	3	92	—	32.
4	20	76	—	22.
3.5	16	79.5	1	30, 31.
3	11	86	—	22.
2	15	82	1	31.
—	13	87	—	22.
—	20	80	—	32.

In the following tables are gathered the compositions of *binary, ternary or quaternary tin- or lead-base alloys* made or specified by engineering concerns of all kinds in Great Britain. Despite the large number of these alloys, the lists cannot be claimed to be exhaustive.

In addition to the many tin- or lead-base alloys listed above, at least one still more complex bearing metal is being used in Great Britain by many well-known concerns. This is a lead-base alloy with a high antimony content, relatively low tin-content, and intentional additions of appreciable quantities of nickel, cadmium, phosphor-copper, and a smaller amount of arsenic. This new *nickel-hardened bearing metal*, of German origin, has only been introduced into local works during the last five years. It compares favourably, as regards hardness and other properties, with more expensive tin-rich alloys, and for many purposes can replace those up to about 85 per cent. of tin. It is being used largely for the bigger type of bearings in which the white-metal lining is keyed into the shell. Its Brinell hardness is 26 at 20 deg. C. and 13 at 120 deg. C. It is thus harder than ordinary lead-base alloys, and retains its hardness better at high service temperatures. Melted under charcoal in the normal manner, it is cast from 480 to 520 deg. C.; specific gravity 9.88; contraction on cooling 0.55 per cent.

Tin-Antimony Alloys.

Plunger operated pressure machine die-castings of special *tin-antimony alloys* are used for gas-meter parts, being produced with a very high degree of accuracy. Table XX shows the compositions of some of those known to be used.

Zinc-Base Alloys.

Most plunger operated pressure machine die-castings appear to be made from *zinc-base alloys* of the types shown in Table XXI. They are very extensively used for instrument parts, automobile accessories, camera, cinematograph, wireless, gramophone and other such domestic or engineering mechanisms.

Solders.

Solders specified by big users in the past have varied widely, under such old-established names as Plumber's Solder, Tinman's Solder and Common Solder. In view of the high cost of tin, it is good that the following specifications now exist for all to use:—

Lead Alloys.

Lead and *lead-rich alloys* are widely used in the chemical industries, and for such purposes their purity is of great importance. The metallic lead content of "chemical lead" is actually specified as 99.99 per cent., but, unless the purchaser has a special restriction as regards the copper content, the lead may be reduced by an amount not exceeding the amount of such copper. The maximum permissible impurities as postulated in B.E.S.A. Specification No. 334, 1928, are:—Copper, 0.05; bismuth, 0.005; iron, 0.003; silver, antimony and zinc, 0.002 in each

TABLE XX.—*Alloys used in Gas Meters.*

Composition, per cent.				Type of Meter.	Alloy used for:—
Sn.	Sb.	Pb.	Cu.		
91.8	8·2	—	—	Wet	Measuring drums.
90	6	4	—	Dry	Crank arms.
80	—	2.8	17·2	,,	Cranks.
70	30	—	—	,,	Covers.
68	32	—	—	,,	"Grating metal."
66.6	33.3	—	—	,,	Valve grids and covers.
65	35	—	—	,,	Somewhat harder do.
64	36	—	—	,,	"Cover metal."
32·4	5.0	59.9	0.65 Fe 0.05	,,	Valves.
10	6	84	—	,,	Rod studs, crank studs, motion wire guides, rollers, tees and valve guides.
Also a copper rich alloy.					
17·2	—	2.8	80	Wet	Drum shafts and bearings.

case; nickel and cobalt, 0.001 per cent. Tin, cadmium and arsenic may be indicated, but only in so minute quantities as to be negligible in comparison with the amounts of other impurities.

Regulus Metal.

Lead-rich alloys are widely used in the chemical industries under the name of *regulus metal*. With 7 per cent. of antimony present, the lead alloy is suitable for tanks, acid eggs, acid pans and other such containing vessels. Lead with 9 per cent. of antimony is used for valves, ejectors, acid pumps, plugs, pans and working parts which must withstand abrasion or other mechanical action. Parts which require to be machined all over, or threaded as screws, are cast from lead with 11 per cent. of antimony, and still higher antimony lead alloys are also used.

The B.E.S.A. recently published a standard specification for such alloys, which contains useful recommendations as to their analysis, and describes suitable plain bend and reverse bend tests (carried out on a strip of cast alloy) by which the quality of regulus metal is judged. Regulus metals are essentially pure lead, and the specified percentages of antimony and permissible impurities are:—Arsenic and zinc, 0.01 per cent. maximum in each case; copper and tin, 0.10 per cent. maximum in each case; and sulphur, 0.02 per cent. maximum.

The minimum tensile values for these four grades of antimony-lead alloys are:—With 6 to 8 per cent. of Sb present, 6,000 lbs. per sq. in.; with 8 to 10 per cent., 7,000 lbs.; with 10 to 12, 8,000 lbs.; and over 12 per cent., 9,000 lbs. per sq. in. The corresponding minimum Brinell hardness figures with 500 kg. pressure and using a 10-mm. ball are 15, 16, 17 and 19.

(To be continued.)

TABLE XXI.—*Zinc Base Die-Casting Alloys.*

Composition, per cent. Zn.	Sn.	Cu.	Al.	Uses.	Strength. U.T.S. tons/s q. in.
Remainder	7–10	4–7	0.5–1.0	Where greatest dimensional accuracy is required	10
Remainder	traces	3–5	4–4·5	Where strength and toughness are more important	19

TABLE XXII.—"*Soft solders.*" (*B.E.S.A. No.* 219—1925). *Soft solders must contain no Aluminium or Zinc, not more than* 0.02 *per cent. Iron and not more than* 0.05 *per cent. Arsenic.*

—	Composition, per cent. Sn.	Pb.	Antimony. Sb.	Max. Impurities.	Uses.
A.	64–66	Balance	1.0	0.25	Low melting point. Steel tubes.
B.	49–51	,,	2.5–3.0	0.25	Tinsmiths' and coppersmiths' fine work and bit soldering.
C.	39–41	,,	2–2.4	0.25	General work.
D.	29–31	,,	1.0–1.7	0.25	Plumbers' wiped joints.
E.	94.5–95.5	,,	0.5	0.25	Special electrical.
F.	49·51	,,	0.5	0.25	General electrical zinc and galvanised ironwork.
G.	41–43	,,	0.4	0.25	Dipping baths, zinc and galvanised ironwork. Tinned electrical joints.
H.	34–36	,,	0.3	0.25	Lead cable wiped joints.
J.	29.31	,,	0.3	0.25	Dipping baths.

A PROGRAMME of research work for 1930 is announced by the Tin Industrial Applications Committee, which is working in co-operation with the British Non-Ferrous Metals Research Association to investigate the industrial applications of tin and discover new and improved uses for the metal. The main lines of research will be:—(1) To investigate the non-corrosive qualities of tin in relation to other metals with a view to establishing scientific data as to its industrial value; (2) to investigate improved methods of plating steel with tin with a view to broadening the market for the canning of foods; (3) to investigate the value of tin in relation to the lubrication of high-speed machinery; and (4) to establish the non-toxic qualities of tin as the safest metal to be in contact with milk and other foods.

Book Review.

Blast Furnace Practice, by FRED CLEMENTS, M.Inst.C.E. Vol. III. Operation and Utilisation of Subsidiary Products. Pp. 400, ill. London, Ernest Benn, Limited. 1929.

The concluding volume of this work (previous volumes were reviewed in our issues for May 23, 1929, and October 24, 1929) deals mainly with details of furnace operation. The author deals first with the calculation of the furnace burden in order to obtain a particular pig composition, and with the control of furnace temperature and physical condition. A most valuable pair of chapters follow on blowing in, damping down and blowing out, a procedure of which British operators have during the past few years had many opportunities of gaining experience; and on certain operating difficulties such as hot spots, hard taps, scaffolding, stove troubles, etc. Safety and hygiene are next considered, with the economics of labour employed at blast furnaces and records of operation and cost.

The remaining chapters are concerned with the cleaning of blast-furnace gas and its utilisation in the generation of power; the precipitation and use of flue dust, the use of blast-furnace slag. The production of ferro-alloys, like ferro-manganese, is rightly given a separate chapter, as is the production of charcoal and electric-furnace pig. The information on products of ferro-manganese is of particular interest. Like the other volumes, this one is lavishly illustrated with photographs, tables and diagrams. It betrays continually the results of first-hand experience and of wide knowledge of conditions in other countries as well as our own.

Now that the series of volumes is complete, it is possible to view the work as a whole. Considering the diverse nature of the material dealt with, the treatment appears to be eminently practical and logical, and nobody engaged in blast-furnace work can fail to derive from it a considerable amount of valuable information. From the point of view of foundry pig, the data is no less complete and detailed than for steel pig, although we should have liked to see rather more extended treatment of certain points referred to in the first volume—the effect of blast temperature on composition and properties, as illustrated by hot- and cold-blast irons; the effect of composition *per se* on the properties of pig-iron; fracture *versus* analysis as a guide to properties, etc. But it would be ungrateful to cavil at these points in view of the vastness of the ground that has been so admirably covered.

Publications Received.

The Movement for a Sounder Money, issued by the Stable Money Association, of New York. 1929. 54 pp. Price, to non-members, 50 cents.

A series of excerpts from speeches and articles by a number of international authorities showing the need for stable-money values. It indicates that a stable-price level is a thing to be desired, second only to international and domestic peace. Many causes affect money values, amongst which may be mentioned the repudiation by certain American States of their debts to this country, the enormous flow of money to America in settlement of inordinate demands for payments incurred during the world War, the Bryan "free silver" campaign, high cost of living during and after the war, various strikes and stock exchange panics. Sir Josiah Stamp is quoted as saying that the problem of the price level is fundamental to a solution of trade depression, labour unrest, class hatred, high taxation, etc. "The change in the price level in the last three years has increased the burden of the national debt by a thousand millions" is a statement that does not affect business men to anything like the extent its importance demands. Ten years' work in building up a spirit of solidity and community of interest in the productive field can be destroyed by a single years' fall or rise in the price level.

The Association believes that wide fluctuations in the purchasing power of money can be prevented, but does not advocate any particular method or plan.

Wrought Alloys of Aluminium in Aircraft, by GEORGE MORTIMER. Published by the British Aluminium Company, Limited, Adelaide House, King William Street, London, E.C.4.

In ferrous metallurgy there is a well-defined line of demarcation between the wrought and cast material, but not so with the aluminium alloys. Because of their synchronous development, their metallurgy is common to both founder and fabricator. This happy state of affairs makes this publication of real interest to foundrymen, and Capt. Mortimer has the facility of writing in an extremely interesting fashion. He has the rare gift of translating the results of research work into practical data of the utmost utility. Though not on foundry practice, we strongly advise our readers to procure a copy of this 36-page, well-illustrated brochure, as it will throw light on many of their related problems.

Patent Specifications Accepted.

The following list of Patent Specifications accepted has been taken from the "Illustrated Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The last numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

Iron and Steel and Metallurgy.

18,717. SCHRÖDER, E. Electric heating devices for welding, soldering and annealing. 292,985.

19,413. COLEY, H. E. Internal heating of ore-reducing chambers and other furnaces. 317,952.

21,136. KELSEN, E. Process and apparatus for electrolytically manufacturing metal sheets and tubes. 294,541.

25,057. JOHNSON, J. Y. (I. G. Farbenindustrie Akt.-Ges.). Manufacture and production of iron alloys from pulverulent initial materials. 317,998.

38,330. KIRCHOF, A. Purifying metals used for castings. [Addition to 278,164.] 318,073.

32,575 GORDON, F. F. Manufacture and production of hollow drill steel. 318,266.

10,302. ASHCROFT, E. A. Treatment of ores and the like for the separation of metals and their salts. 318,301.

The Future of British Foundries, with Special Reference to Continuous Castings.*

By A. S. Beech.†

Introduction.

He would be a very brave man who would endeavour to prophesy what is to happen in the foundry industry of Great Britain within the next decade. The industry may be on the eve of obscure yet startling mechanical or scientific developments, but it is possible to foresee advancement in two definite directions.

If British industry does not advance rapidly along these two roads foreign competitors will get so far ahead that it will be very difficult to overtake them. Already, in various parts of the world, the industry is well ahead of Britain, and it is a matter of very serious moment that Britain should do all possible to keep its industry abreast of its foreign competitors in these respects. The two subjects are (1) the general adoption in many industrial European countries of the continuous casting system, and (2) adequate scientific training of boys and young manhood during and after apprenticeship.

The author is convinced that in these two matters Britain is very far behind France and several other Continental countries. What does it mean if Britain is content to muddle through? Perhaps not a great deal for the actual moment, but imagine what it is going to mean in a few years' time. Take France, of which country the author has most knowledge, due to his many visits there, and thus can speak with certainty as to prevailing conditions; in this country before many years have elapsed, one will find continuous casting plants installed for mass production and export of castings to all countries in the world, controlled by a large number of active young foundrymen, chosen from the Public Schools and possessing knowledge which British youths cannot possibly hope to acquire with the facilities at present obtaining in this country. If British foundrymen do not take prompt and adequate action they will be left behind in these two matters. Happily, however, British manufacturers do seem to be at least talking of improving their plants, and, further, it was pleasing to hear Mr. Wesley Lambert, the President of the Institute of British Foundrymen, say in London, in June last, that it was his intention to see whether it was not possible to mark his year of office by tackling seriously this important question of foundry training, by emulating France and starting a school of a similar nature to the French Higher Foundry School in this country. Thus there has been a little progress, and it now remains to put these aspirations into actual practice as far as the continuous casting schemes are concerned, and to find a man, or men, with sufficient skill, knowledge and enthusiasm to take up this most important educational work in this country.

If there were no benefit to be derived from these ideas of continuous casting, one may be sure that Americans, hard-headed business men as they are, would never have adopted them, and would certainly not go on spending vast sums of money to expand them in all directions, unless they were a paying proposition. On the other hand, turning to Europe, one finds that in France, Belgium and Germany, and in Italy, these plants are being erected and extended in every direction. In Great Britain, so far, foundries have lagged behind, and in fact there are very few plants actually working on these lines at the present time. Nevertheless, there is considerable interest in this country, and the author is personally aware of over a dozen companies who are considering very carefully schemes and drawings at the present moment for the installation of continuous casting. As is always the case, and rightly so, whenever any new schemes for increasing production are initiated, they are immediately assailed from all quarters, but an appeal is made for constructive, and not destructive, criticism. There are difficulties in the way in Europe as compared with U.S.A., but they are not insurmountable, and if goodwill exists on all sides they can be overcome.

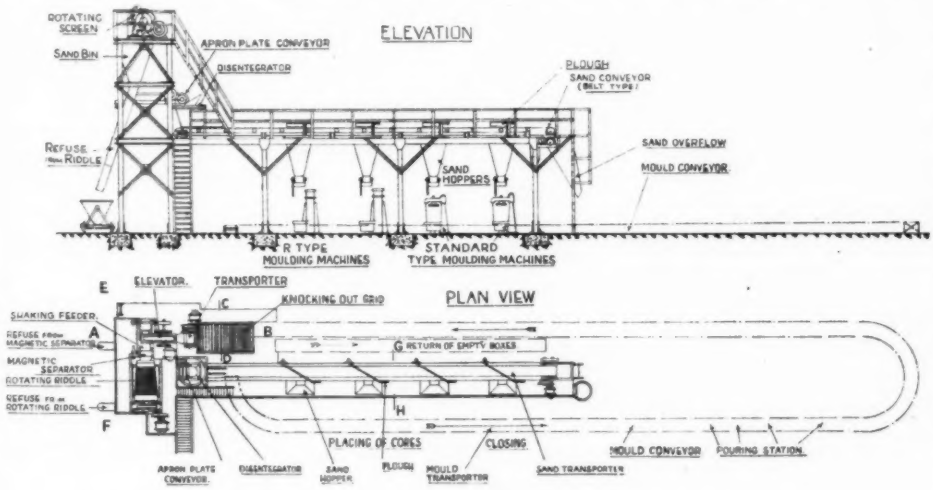


FIG. 1.—SUGGESTED LAY-OUT FOR A CONTINUOUS MOULDING FOUNDRY.

Continuous Casting.

Visitors to America in the last few years have been amazed at the large number of foundries which have adopted continuous-casting methods, at the continual extension of these methods in all directions, and of the enormous output per man obtained from these installations. In fact, any company to-day in the U.S.A. having repetition castings to make could not exist unless they have adopted these methods of manufacture. This movement was recently stressed by the statement of a friend who, after visiting several stove-plate works in U.S.A., was surprised to find that most of the stoves, instead of being made from cast iron, were being fabricated from pressed sheet. It appears that in the stove-plate foundries the men did not welcome the use of these new methods, and as a result it was found that the cheaper way of making a stove was to make it from pressed sheet, which was turned out by mass production methods, and as a consequence could very easily compete with the hand-made cast-iron plates. The result was obviously disastrous to the iron moulders, and it affords a good example of how work may be lost to any particular industry unless both masters and men mutually recognise the great importance of modern labour-saving machinery and ideas.

Origin of Continuous Casting.

Perhaps it is not generally known that the idea did not start in America at all, but in France. The first automatic and continuous casting plant which can be traced was installed in France in 1880, under the direction of M. Godin, at Guise, whereas the first installation in America would appear to be the Westinghouse Air Brake Company, who started their plant in 1893.

Advantages of the System.

The benefits to be derived from the installation of continuous-casting plant are quite apparent, especially where large repetition quantities of castings have to be made. Briefly, they are:—(1) Greatly increased output per man engaged; (2) the floor space is used over and over again during the day, and as a foundry "lives" on its floor space, the overhead charges fall considerably; (3) costs of castings are reduced considerably, and as a result old markets are retained and new ones obtained; (4) owing to the mechanical manufacture of the moulds and definite handling of all raw materials, castings are more accurate and scrap castings are reduced to a minimum; (5) wages are increased and the

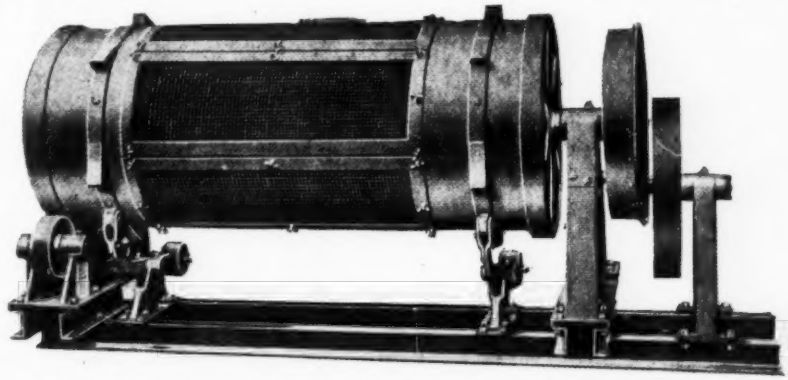


FIG. 2.—CYLINDRICAL RIDDLE SUITABLE FOR INCORPORATION IN CONTINUOUS MOULDING PLANTS.

* A Paper presented before the Wales and Monmouth, West Riding of Yorkshire, and the Newcastle Branches of the Institute of British Foundrymen.

† The Author is Managing Director of the Universal System of Moulding Machines & Machinery Company, Limited.

increased spending power of the worker means ultimately the general increase in trade over the whole country, and (6) continuous use of same moulding boxes and other plant many times during the day.

It is admitted that the conditions existing in the United States of America and in Europe are not always parallel. In America they have a large source of immigrant labour from which to draw; they have the largest domestic market, and the mass-produced article is universally accepted by their large population. In Great Britain, and in fact all over Europe, the same conditions do not always apply. There are smaller populations in the individual nationalities. Europeans have always been spoilt by the manufacturer. In other words, he has made what the people like. In America the people have, to a large extent, to take what the manufacturer thinks he will make for them. Both points of view have their advantages and disadvantages.

On the other hand, in Europe to-day there are many articles in universal demand which could easily be made by continuous casting methods, and, to meet the particular European needs, plant and machinery has been specially designed. In America there are entire continuous casting units, devoted to the manufacture of one size and one type or class of casting, that is to say, perhaps 20 or 30 moulding machines, all making identically the same casting, all the year round, in one plant. Here, however, such conditions could not apply, except in isolated cases, so that it follows that if Europe is to make headway with continuous casting it is necessary to design and build plant embodying greater elasticity.

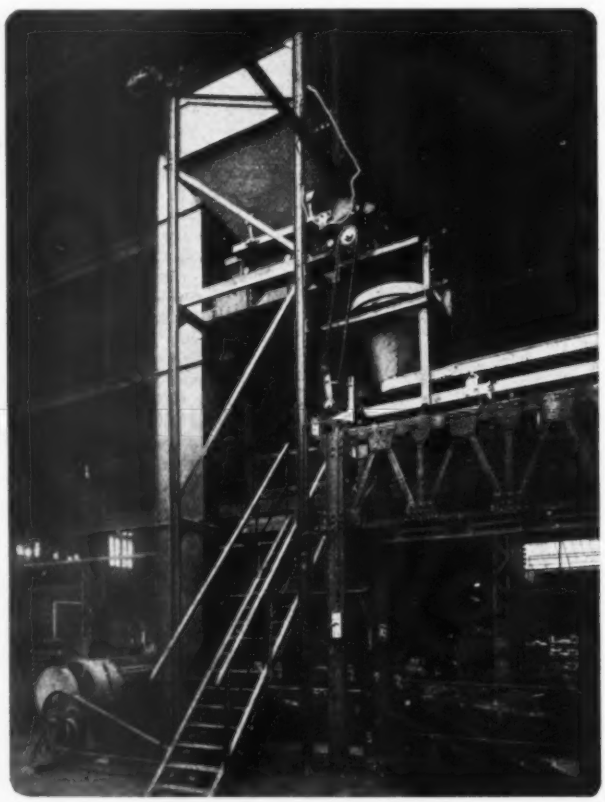


FIG. 3.—LARGE STORAGE BIN INCORPORATED IN A CONTINUOUS CASTING PLANT.

Essential Requirements.

Continuous-casting plant must be an installation with every unit of the plant designed for a continuous flow of materials, and for the repetition of operations at a maximum working speed. The supply of sand to the moulds, or the supply of metal for pouring, must be regulated in such a manner that they are both available and in good condition when required. The time taken to make the mould must therefore govern the rate at which the castings can be manufactured and the speed of arrival of the sand over the machine and the metal at the pouring point.

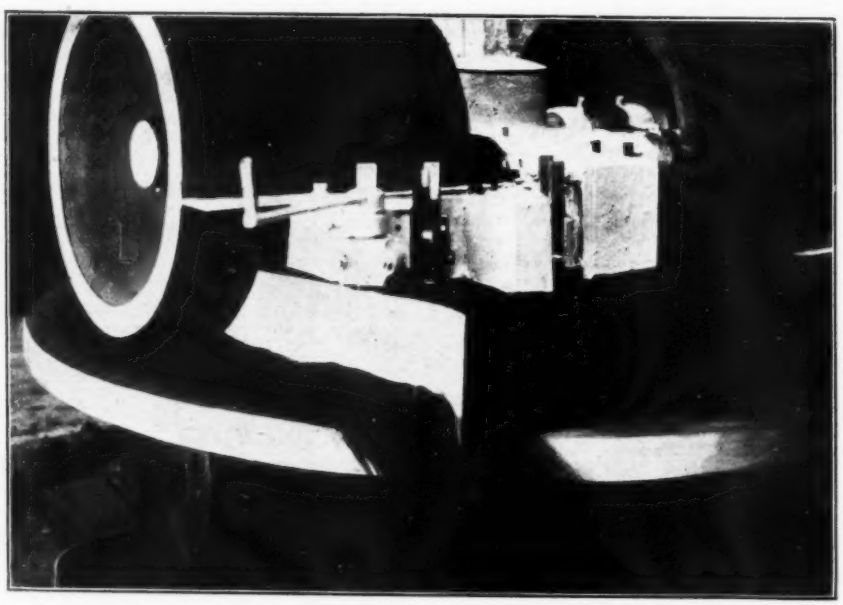


FIG. 4.—AN AUTOMATIC CONTINUOUS SAND MILL, OF 13 TONS PER HOUR CAPACITY, SHOWING THE METHOD OF DISCHARGE.

In some of the plants which have been designed and installed it is now possible, with latest types of hydraulic moulding machines, fitted with patented down-sand frames, actually to ram a mould and draw the pattern in 4 to 5 seconds, or even less; the rest of the time, and by far the greatest part of the time, has been spent in putting the box on to the machines and, in the case of non-automatic plants, shovelling the sand into the box and carrying the box to the floor from the machine.

With these latest types of moulding machines, embodying down-sand frames, one cannot possibly expect to speed up the actual moulding and pattern drawing, and the only saving now is to be effected by the use of the automatic conveying of sand to the moulding machines, the automatic conveying of moulds from the machines, and in fact all conditions that go to make up continuous casting.

Cycle of Operations.

The cycle of operations, therefore, in the scheme shown in Fig. 1 is as follows:—The moulding-sand mixed with a measured quantity of new sand and coal dust, passes over a magnetic pulley, which rids the sand of any tramp-iron which may be present. It is then elevated to an overhead riddle for sieving and preliminary mixing. Under this riddle is placed a large storage bin. This storage bin should be capable of holding at least two to three hours' supply of sand, the reason for which will be dealt with later. The quantity of sand required is automatically taken from the bottom of this storage bin and is passed either through a paddle mixer or a continuously-operating sand-mill. Either the paddle mixer or the mill must be chosen according to the requirements of the foundry, as to the quality of the sand. Undoubtedly the mill gives the better results, but on some occasions the casting does not need such a good skin and the paddle mixer suffices. If water be necessary for re-moistening the sand, it is added either at the mixer or the mill. The sand is then again elevated to a disintegrator in order to open up the texture and aerate it. From the disintegrator the sand is automatically conveyed by either a flight-type or belt-type conveyor to the individual hoppers, situated over each machine. The operation of moving this sand round is repeated several times a day, and obviously the number of times depends on the class of casting to be produced, and most of all on the capacity of the storage bin.

The moulding machine plant will, of course,

consist of the best types of machines for the work to be achieved. In Fig. 1 all the machines shown are hydraulic machines, fitted with down-sand frames. The first two machines are of a roll-over type and are used for moulding the bottom halves of the mould, whereas the other two are of a standard stationary type, used for making the copes of the mould. The drags are made first and put on to the mould conveyor and are closed as they pass the cope machines. It should be noted that it is quite unusual to have only four machines per unit, generally there are eight to fourteen machines.

The moulding boxes are fed with sand automatically from the hoppers situated over each machine, and all that is required is for the operator to pull a handle, when the sand falls automatically into the box. The finished moulds can then be lifted away from the machines, either by crane or hand, depending on the weight, and placed on the conveyor. Mould conveyors are shown placed around the machine, and the moulds travel on this conveyor from the machines to the pouring point, and from the pouring point to the knocking-out grid.

side the mould conveyor, at a point just after the moulds have passed the last moulding machine on the unit. The reason for this is quite clear, as it is useless to arrange for any longer travel for the mould than necessary and the sooner it is poured after moulding the better.

Pouring Conditions.

With regard to the actual pouring, the author suggests, for an installation of this description, that ladles should be filled with molten metal either direct from the cupola or from a reservoir ladle, but in every case where it can be arranged these pouring ladles should be suspended from a mono-rail overhead. This mono-rail is made in circular or oval shape, so that full ladles can come up one side and the empty ones go down the other side, back to the cupola for refilling, without impeding the progress of the work in any way.

This mono-rail has many advantages; pouring is not always a very agreeable job, especially in hot weather, and it is a great relief to the men not to have to carry shanks of hot metal to and from the

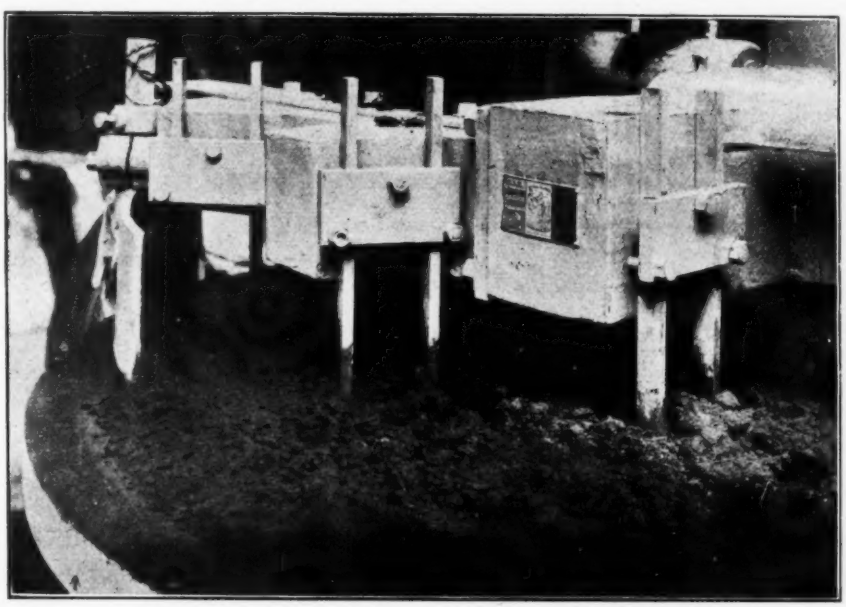


FIG. 5.—CONTINUOUS SAND MILL, SHOWING CUTTING ACTION.

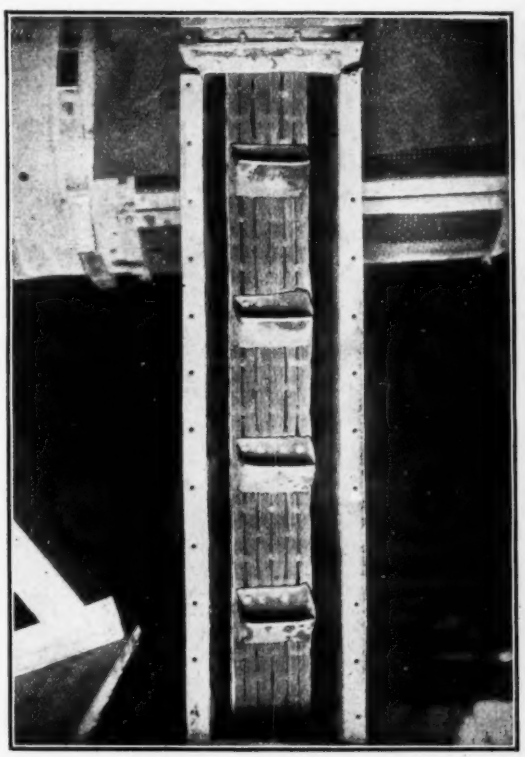


FIG. 6.—SAND ELEVATOR, MOUNTED ON FLEXIBLE SPECIAL FABRIC.

The empty boxes are returned to the machines by means of another conveyor or on the same conveyor if it is automatically controlled. The mould conveyor, of course, should be made sufficiently long to allow the boxes to travel a certain distance, to give the necessary cooling time for the castings after they are poured. The moulds are then shaken out over the knock-out grid, and this knocking out can be done in the ordinary way, by hand, or it can be accomplished by means of what is termed an automatic knocking-out apparatus. This apparatus is composed of two grips which are suspended on a pulley-block, or some means for lifting up the boxes. On these grips are fitted very strong compressed-air vibrators. The vibrators are put into action and the sand is automatically shaken out and falls down the knock-out grid.

From this grid the sand is automatically conveyed to the sand plant for reconditioning, and usually any new sand is added either at the knock-out grid or somewhere in the system before the reconditioning is to take place. This is only a minor detail and has to be arranged to suit individual cases. The castings knocked out of the boxes can be either transported to the fettling shops by trucks, or roller conveyor, or slid down a gravity track made from mild steel plates.

The pouring station is usually arranged alongcupola, especially when they are pouring practically all day long. It will also be seen that several ladles can be suspended on the same mono-rail, thus expediting the work considerably. It should be emphasised that this lay-out is not suitable for all plants. It is simply given as an example, and almost every one of these continuous lay-outs has to be carefully and individually studied and designed to give the best results in the particular foundry where they are to be installed. Every foundry differs in the construction of the building, in the methods of working, and, of course, naturally every foundry has its own class of casting to make.

Screening the Returned Sand.

Fig. 2 shows a cylindrical riddle which is in great favour for use in continuous casting plants. It has been shown that the sand is knocked out through a grid in the floor. The sand falls through this grid and then falls on to a belt, made of special material, for conveying hot sand. This belt is more serviceable when made of endless steel plates, fitting into each other and driven by two drums, one situated at each end. This plate conveyor takes the sand usually over a magnetic pulley, where all the pieces of iron are extracted, and from this magnetic pulley the sand falls into the boot of an elevator. From the elevator it is conducted into the cylindrical riddle (Fig. 2). In some plants, however, the flat screen, or "Hum-mer" screen as it is called in America, is gradually gaining favour over this cylindrical riddle, owing to the fact that if the new sand introduced at the knock-out grid happens to be damp or in lumps, and as a consequence cannot pass the meshes of the cylindrical riddle, it gradually travels to the other end of the riddle, and finds its way into the refuse pipe. With the flat screen, with fairly large mesh this is very rare, and the lumps are bounced up ond down on the surface and eventually they are knocked about until they get smaller and finally pass through the mesh of the screen.

The problem of cooling and reconditioning of sand appears at the first outlook to be one of great difficulty, but this is overcome by installing what is known as a sand redistribution or storage sand bin. The size of this bin naturally depends on the requirements and conditions of the foundry. It should, however, be of a capacity to hold at least two to three hours' supply of sand, or even more. By this method the sand is not being sent through the system too quickly, thus allowing it time to cool, and, moreover, the bonding power of the sand is being preserved to a great extent. At the bottom end of the storage bin is fitted an endless belt, and this feeds the sand automatically and in the required quantities, according to the speed at which it is revolving either into the sand mill or paddle mixer, or, in some cases, direct into the disintegrator.

Backing and Facing Sands.

Generally speaking, in a continuous-casting plant the sand to be used in large quantities is the backing sand, which does not require sand-milling. In this case the facing sand is supplied to the machine moulders in bins, which are placed close to the moulding machines. In many cases, however, it is desirous that these facing-sand bins are eliminated, and in such cases either a sand mill, where specially good sand is required, is installed, or when the bond and skin

Fig. 7.—Sand Disintegrator.

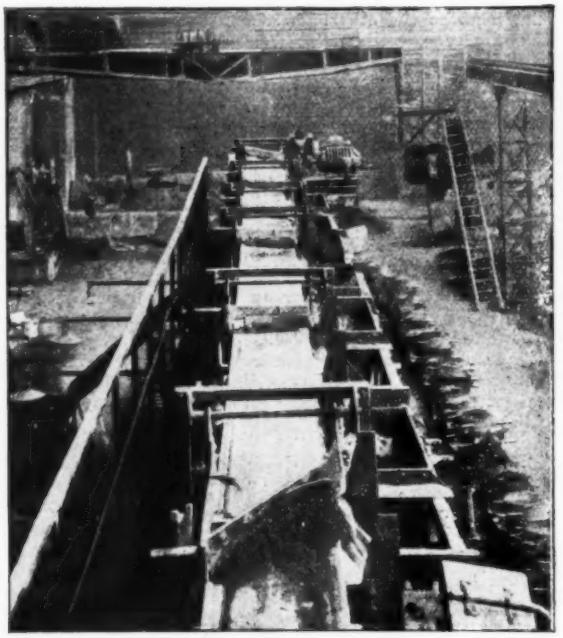


Fig. 8.—Sand Conveyor of the Belt Type.

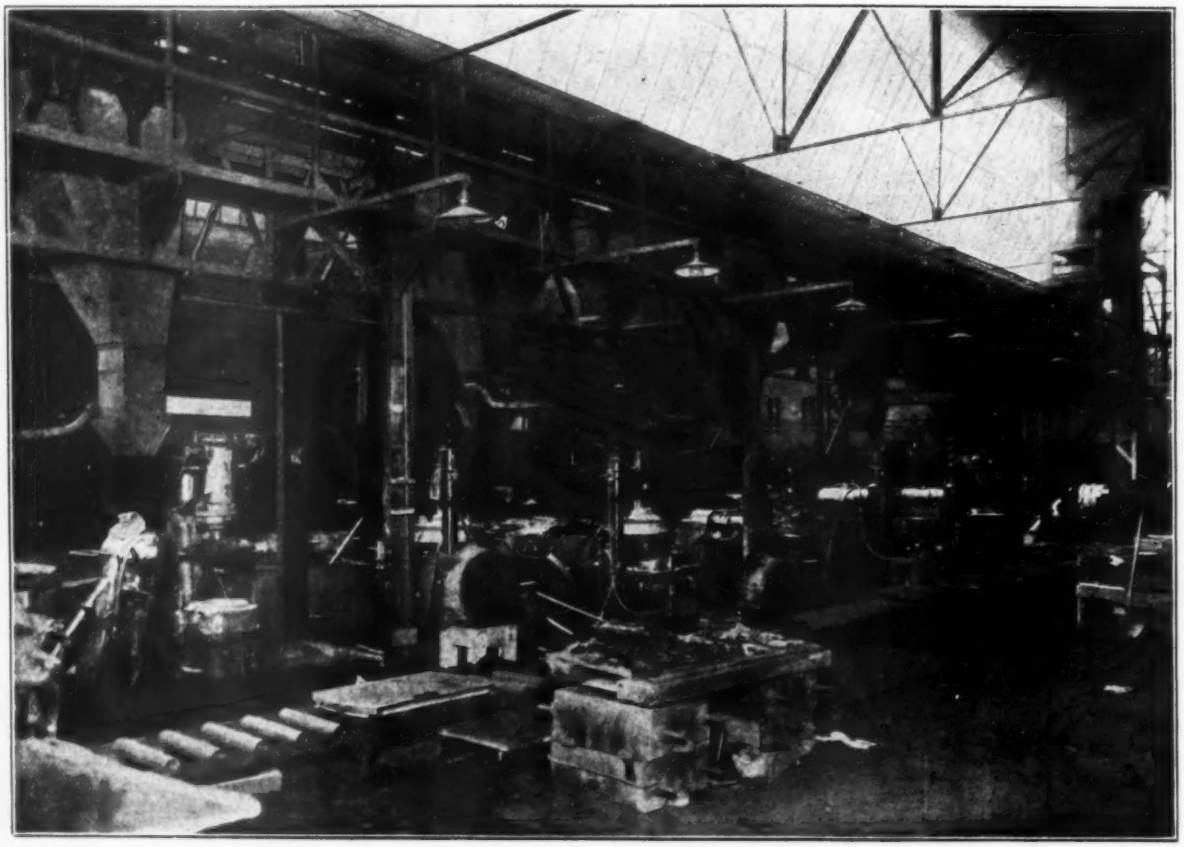


Fig. 13.—View in the Nancy Foundry of the French Thomson-Houston Company.

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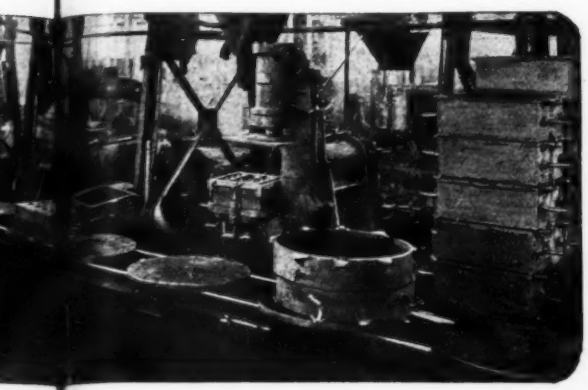

Fig. 12.—Chain-driven Sliding Plate Conveyor.

Futu[re] of British Foundries, with
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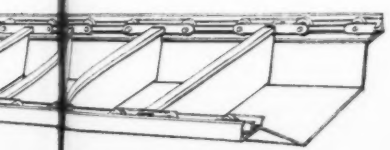
by

A. S. Beech.



. 9.—S[ec]onveyor of the Flight of Scraper Type.

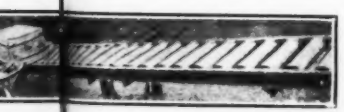


Fig. 1[0].—Normal Type of Roller Conveyor.

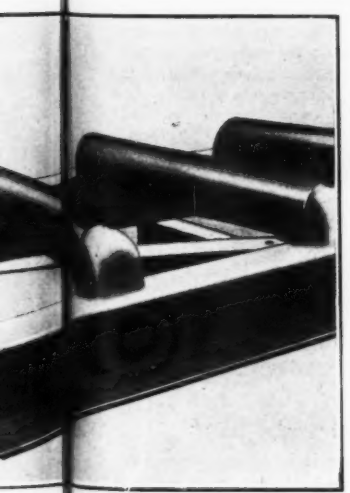


Fig. 1[1].—Special Type of Roller Conveyor showing Method of Mount[ing].

Fig. 15.—Continuous-Casting Plant at Messrs. Massey, Harris & Company.

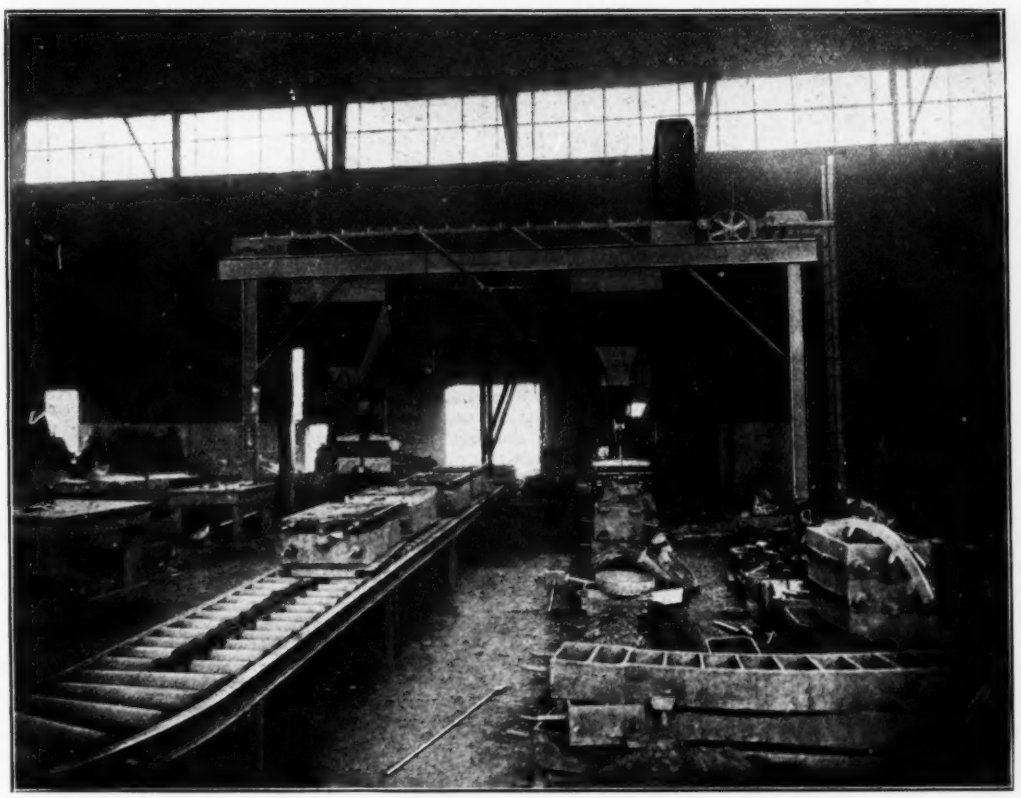


Fig. 14.—Continuous-Casting Plant at the Stanton Iron Works Company.

of the casting is not so important a paddle mixer is included. Figs. 4 and 5 show a continuously-operating sand mill.

These mills are generally placed in such a position so that the sand is fed from the storage bin, shown in Fig. 3, into the centre of the mill. The action of the mill is such that the sand is worked passing under the rollers, and eventually is pushed by scrapers to the outside periphery of the plate (this mill has no pan but simply consists of a flat plate). From this mill it passes either direct into the sand disintegrator, or more frequently into the boot of a second elevator, which lifts the sand up again to the top of the installation and afterwards passes the sand through the disintegrator into the sand conveyor. The paddle mixer mentioned previously is composed of a trough containing paddles or beaters, and the sand is fed in at one end, and the action of these paddles gradually pushes the sand to the evacuation end.

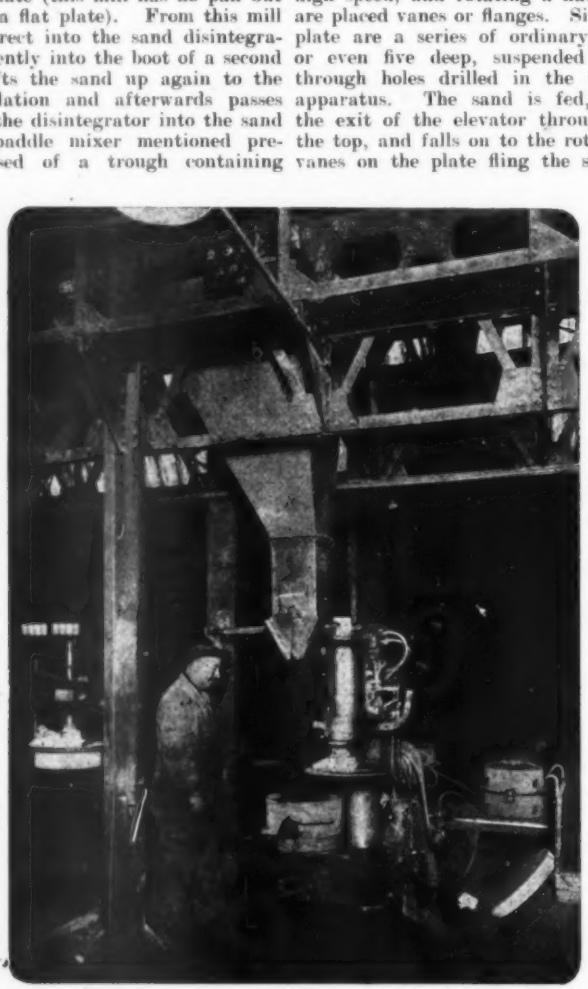


Fig. 16.—Feeding of Sand into the Moulding Boxes Automatically.

Sand Elevation.

Up to the present, particularly in Great Britain, sand elevators have very often been composed of buckets fastened on to chains. These chains are continuously running through sand, and in order to keep them in good working order it is necessary to grease each link from time to time. The merest novice in engineering knows that grease and sand do not make for "ideal lubrication," and the wear that takes place on these chains is a very strong reason for superseding this method of elevation. In Fig. 6 (which, by the way, shows the bucket on the down-path) it will be seen that the buckets are suspended to thongs of leather and that steel rods are placed laterally through this leather at intervals. This results in a very strong elevator, and from actual practice it is shown that it works particularly well.

Sand Disintegration.

Fig. 7 shows a special type of disintegrator, specially designed for operation with a continuous plant. As a rule this disintegrator is placed at the top of the elevator so that any sand which may have become agglomerated or lumpy, owing to the action of the elevator, may be broken up and aerated before passing to the conveyor over the moulding machines. This machine is of peculiar, though quite simple construction. It is composed of a totally-enclosed, hermetically-sealed motor, revolving at a very high speed, and rotating a flat plate, on which are placed vanes or flanges. Situated round this plate are a series of ordinary long nails, four or even five deep, suspended by their heads, through holes drilled in the top plate of the apparatus. The sand is fed, therefore, from the exit of the elevator through the funnel at the top, and falls on to the rotating plate. The vanes on the plate fling the sand centrifugally through the nails, and as these nails are not in a fixed position, but are simply loose, the vibrating action breaks up the lumps of sand. It also cools the sand very efficiently and eventually delivers it by gravity, in a perfect aerated condition, on to the sand conveyor for distribution.

Belt and Plough Type of Sand Conveyor.

The type of horizontal conveyor shown in Fig. 8 is used to bring the sand from the disintegrator to the hoppers, situated over the top of the moulding machines. It is composed of an endless belt made from a special hard-wearing material, and the sand is fed on to this belt from the disintegrator. As the belt is being driven over rollers or pulleys the sand travels automatically along the face of this belt. When the operator of the moulding machine requires more sand in his hopper he simply pulls a lever, which places on the belt a plough in a diagonal position, and thus this plough simply scrapes off the sand from the belt into the top of the hopper. The plough and the action are seen quite clearly in the illustration.

Scraper Type of Sand Conveyor.

The scraper type of conveyor is more expensive than the one shown in Fig. 9, but it has certain advantages, the principal one being that the supply of sand to each individual hopper is automatically regulated and the sand is more evenly distributed. It is composed of a channel in which is operated an endless belt of "scrapers" or flights, and this belt is power-driven from one end. The sand is fed in from the disintegrator and distributed to the sand hoppers over the machine by the pushing action of the scrapers.

Equal Distribution of Sand from Conveyor.

From Fig. 8 it would appear that the first hopper would receive all the sand until it was full, and that all the other hoppers would require to wait their turn. This difficulty is overcome in a very clever, efficient, and simple way. The sand travels along the trough, right across the face of the scraper, until it arrives at the top of the first hopper. A plate or sliding cover is arranged over this first hopper so that only a part of the top of the hopper is left open; thus the sand only falls down through the open space and the rest is taken on to the top of the next hopper. During the transit of the sand from the top of one hopper to the next it has the tendency to form itself once again over the entire face of the scraper. The second hopper has the other side left open and thus the sand at this end falls on this occasion. It must be understood that all the hoppers are left open alternatively, the first at the right, the second at the left, until the end of the unit is reached, when the last one is left open entirely. From actual practice it can be stated this distribution is very effective. Another advantage of this system is that if one or two machines are not required for any purpose it is possible to shut the slide right over the top of the hopper, and the sand will then pass on to the next one which is open, thus isolating entirely the machine or machines which are out of commission.

Roller Type of Mould Conveyor.

The question of mould conveyors is quite an important one, but the type to be employed depends to a very great extent upon the type of work to be produced and the quantities of castings required, and, moreover, on the speed at which the moulding machines are being operated. Roller track conveyor has many advantages, and also, like many other things, some disadvantages. Up to the present, roller track has generally been made from steel tube with a spigot in the end, and set in ball bearings and passed into holes drilled through angle iron. This method of manufacture, whilst being in the first place cheap, is really false economy, because the life of this type of roller track in the ordinary foundry is very short, particularly where heavy moulds and boxes are being transported. From experience, it has been found that the continual banging of boxes on to this type of conveyor, and the frequent passing over these rollers of heavy boxes, results in indentation of the rollers, and this means that when the subsequent moulds pass over these indented rollers a rocking action is produced and moulds are frequently shaken or broken. It is patent that this is a dangerous state of affairs, because, if the moulds are delicate, small particles of sand may easily be shaken down into the moulds, thus resulting in faulty and dirty castings. Another adverse criticism of this tubular roller track is that as the bearings at the angle iron are so small, the ball-races are as a consequence also very small, and these quickly liable to get out of order.

New Type of Roller Gravity Track.

Because of these troubles it has been necessary to design a new roller track for the transportation of moulds. Fig. 11 shows this new type. It is composed of rollers cut out of the solid bar, and the ends of these bars are machined out, and hardened steel spigots of adequate diameter are driven into them, and these fit into

dustproof bearings. These bearings are mounted by means of nuts and bolts on to the *top* of the angle iron. Naturally, it is a more expensive construction initially, but the life is practically everlasting. No indentation can take place owing to the use of the solid bar in place of tubes, the ball-races are large and run sweetly, and finally, the surface on the top of the rollers is very smooth and true, as the bearings are all in alignment with each other and are self-aligning, which is very rarely the case with the tubular track. In all cases of roller track it is necessary to use a mould-carrying tray or plate, on which to deposit the mould to ensure sweet running. This plate is usually composed of non-inflammable wood covered with perforated steel sheet. The roller track presents the following advantages:—(1) It can be placed on the slant or parallel, as necessitated by working conditions, and thus the moulds can be passed along either quickly or slowly, as requirements demand; (2) it is an easy matter to replace another length into the track, or remove a length in case of necessity; (3) where very long cooling time is necessary it is ideal, because it can be made to any length or go in any direction for this purpose, and (4) it is very useful for conveying of castings to the fettling shop or bringing boxes, etc., back to the machines.

Chain Driven Sliding-Plate Conveyor.

This type of conveyor is very useful, especially where large mass-production has to be obtained. The advantage of this type is that it is being driven at a steady speed and is moving all the time. As a consequence of this it might be termed a "pace-maker" for the men operating the moulding machines. In other words, the men must work at a certain speed in order not to send through too many empty plates. The superintendent of the plant would very soon see that the men were not working so well as usual if there were too many plates coming through without moulds. It is, however, very rigid and definite in its movements, and where regular quantities of approximately the same weights of castings are being handled it is strongly to be recommended. On the other hand, it is power-driven, and as a consequence it is more expensive to install and work than the roller track.

Iron and Steel Production.

The National Federation of Iron and Steel Manufacturers, in their Statistical Bulletin for November, report that for the third month in succession the number of furnaces in blast at the end of the month showed a slight decline, so that the furnaces in blast, which numbered 170 at the end of August, 168 at the end of September, and 166 at the end of October, numbered only 163 at the end of November. Production of pig-iron fell to 631,400 tons, the lowest for any month since last April. The daily rate in November amounted to 21,047 tons compared with 22,216 in October.

Steel production declined to 815,000 tons compared with 889,800 last October and 762,500 tons in November, 1928.

The Board of Trade's index number for iron and steel in November was 114.9 (1913 = 100) compared with 115.3 in October: the index number for "all commodities" was 134.0 compared with 136.1 in October. Returns received from 135 firms employing 86,938 workpeople in November show a decrease in the number employed of 1,644 compared with last October and an increase of 3,887 compared with November, 1928. According to returns from 137 firms employing 120,245 workpeople the average earnings in October amounted to £3 3s. compared with £3 2s. 5d. in September and £2 19s. 4d. in August.

Foundryman as Sculptor.

An interesting piece of sculpture in the Socialist Art Exhibition in Glasgow is a large-scale plaster work, entitled "The Runner," which is the work of Mr. John Longden, foundry superintendent to Messrs. D. & J. Tullis & Company, Limited, Kilbowie Iron Works, Clydebank. Mr. Longden is a self-taught artist, and this model, which was planned and finished in

"THE RUNNER."

his leisure as a hobby, took two years to complete. The work is almost life-size, and represents a runner in full pace; the head is beautifully poised, and the will to win expressed in every curve of the figure. The idea was suggested to the artist by a newspaper cutting sent him by a friend. Mr. Longden is well known in Scottish foundry circles, and was president of the Scottish Branch of the Institute of British Foundrymen last session. His brother, Mr. E. Longden, described the manner in which "The Runner" was made in his Presidential Address to the Lancashire Branch in 1928. This was published in THE FOUNDRY TRADE JOURNAL, October 11, 1928, page 260.

High Wages Pay.

Mr. Sam Mavor, chairman and managing director of Mavor & Coulson, Limited, Glasgow, in the course of a Paper on "Payment by Results," read before the Economic Science Section of the Royal Philosophical Society of Glasgow, said it was too often generally assumed that the desired increase of individual production must come mostly from some spirit of goodwill and great effort on the part of the workmen. That is a mistaken view. Co-operation by the men in utilising the productive machinery to the best advantage was, of course, a very important factor. As an element in costs of production the importance of wage rates was much less than the devising of every possible means of so applying labour that it yielded the maximum effect. Where labour was so applied and adequate inducement was given to the men to utilise the productive machinery to the best advantage, high wages were entirely consistent with low costs of production. It was economic to pay very high wages for proportionately high rates of individual output.

MR. A. H. WOLSELEY, managing director of Messrs. Charles Clifford & Son, Limited, Birmingham, has completed 50 years' association with the company.

Foundry Facts and Fancies.

At a meeting of the London Junior Section of the Institute of British Foundrymen, held on January 3 at the offices of THE FOUNDRY TRADE JOURNAL, Mr. C. Cleaver read a Paper entitled "Some Foundry Facts and Fancies."

The lecturer said that there was often a great lack of knowledge of even the most elementary features of moulding. The bedding of a pattern required considerable moulding knowledge and skill, and it was possible for, say, half a dozen moulders using the same pattern to perform on a mould each in an entirely different manner.

Many wasters were caused through the ramming of the pattern causing the surface of the mould to be hard, whilst the underneath sand was soft and loose, so that when the metal first entered the mould it tended to bubble and scab, and when the pressure of metal fully exerted itself the under portion of sand would shift, resulting in the casting being both scabbed and swollen. The first essential operation, therefore, must be to have the entire surface of the bed of the mould rammed perfectly evenly and soundly. The lecturer touched upon machine moulding and mechanical devices, remarking that these could be a definite asset to the foundry if not abused.

Referring to the cupola, there was no reason why every foundry should not produce good and hot metal from the cupola. There was sufficient data obtainable whereby every foundryman should be able to melt economically and scientifically and, with a knowledge of the materials he was using, *i.e.*, pig-iron, scrap, etc., should be able to calculate within reasonable limits the analysis of the iron being produced, at any rate with sufficient accuracy for ordinary purposes. The use of special irons, of course, necessitated special and careful attention to details, but in ordinary practice the foundryman ought to be able to work with reasonable consistency on the lines indicated. For ordinary foundry practice there was no reason why the cupola should not be standardised.

With correct melting conditions, the task of the metallurgist, or those responsible for the different grades of iron required, was simplified. With a knowledge of the material on hand the arrangement of the charges was not a really difficult matter, and it was possible to figure fairly accurately to the analysis desired. If a laboratory was attached to the foundry so much the better. A closer touch could be kept on all the materials and a checking over of final analysis with the calculated would make for uniformity.

It was essential to have hot metal and clean ladles for casting. Sluggish metal produced bad castings. In the case of spare metal left in the ladle it was false economy to add hot metal from the cupola with the idea of using up this spare metal. Castings made from this metal could not be expected to be good and sound, owing to gases being set up in the metal itself by reason of hot metal being added to metal which was nearly cold. The best and cheapest method of dealing with this spare metal was to run it into ingots which could be remelted in the ordinary way with heads and scrap.

The lecturer then described one or two simple methods of checking the working of the cupola. He emphasised care in feeding and attention to the condition of feeding rods, as the breaking of rods was often a source of trouble and annoyance, resulting in waste castings. The aim must be to reduce the necessity of feeding by rod to a minimum, and he believed it was possible, by proper arrangement of runners and risers, to be able almost to abolish rod feeding, but there was much to be learned in that direction. The principles of hot iron and slow, even pouring were the lines along which he believed the best results would be obtained.

XUM

Jubilee of Steelworks Manager.

The staff of Messrs. Frederick Braby's Eclipse Iron and Steel Works, Glasgow, met on January 10 to do honour to Mr. David MacMillan, the assistant general manager, who has completed fifty years of service in Braby's Glasgow works. Mr. K. D. MacKenzie, Glasgow, director and general manger, presided, and was supported by three London directors, Messrs. Walter Braby (chairman), Cyrus Braby (vice-chairman) and Alwyn Child. At the conclusion of the dinner, the chairman, on behalf of the staff, presented Mr. MacMillan with a Jacobean oak table filled with cutlery, along with a gold watch suitably inscribed. He also presented Mrs. MacMillan with a sapphire and diamond-cluster ring. Mr. MacMillan also received a handsome gramophone from the directors.

MR. MACMILLAN, in returning thanks, said he entered the firm at the age of 12½ years. He took an optimistic view of the iron and steel trade's prospects for 1930. He is a believer in trade cycles and states that, according to the average cycle movements, 1930 will see the end of the present downward period and the beginning of an upward development which will last for four years. 1929 has been a year of rationalisation and reorganisation, preparation of big schemes and the clearing of the decks for a big new trade advance.

In addition to the help given to the steel trade through the De-rating Act, other economies and reductions in cost have been effected. The British railway companies have made economies to the extent of over £6,000,000 per annum, and one large steel concern alone has been able to make a saving in its office and managerial expenditure of £165,000 per annum. Many iron and steel works are more efficient and up to date than ever they were. World competition and low Continental-labour costs have made conditions for some years abnormally severe. We had always, however, to face competition, that was a sign of life. The heavy steel industry was now meeting the competition. British steel plants were working to 80 per cent. of effective capacity, which was as high a percentage as in America. In 1913 British steel production was only at the rate of 7½ million tons per annum, in 1928 it was 8½ million tons, but 1929 had broken all records with an output of 9½ million tons. During 1928 and the first half of 1929 the British output of black and galvanised sheets, flat and corrugated, had been at the record rate of 1½ million tons per annum, 75 per cent. of which had been exported. That meant that we had doubled our output in 20 years.

Mr. MacMillan said that he did not agree with the opinion that the world had reached the saturation point as regards steel and steel products. There was at the moment under consumption, due to uncertainty and want of confidence, but there could not be over-production so long as there were so many valuable portions of the world undeveloped, including British colonies and dependencies. He remembered 20 years ago that the world output of steel was at the rate of 40 million tons per annum, and it was declared that the saturation point had been reached. That was nonsense, to-day the world is consuming 100 million tons per annum, Britain's share being nearly 10 per cent. It had to be borne in mind that in fifty years the world's population had increased by fifty per cent., and that the standard of living was much higher, consequently the demand for goods was enormously greater. For example, new uses were being found for steel sheets, In addition to buildings, sheds and fences, they were also being used for railway carriages and wagons, motor bodies, stairs, flooring, partitions, skylights, enamelled stoves and cooking utensils, domestic and office furniture, windows, signs, garages, barrows, bins, buckets, etc.

It had to be admitted that Britain's reservoir of labour was abnormally high at present, in fact, the reservoir had overflown its banks. The remedy was to find new outlets for British products and to bring costs down to the lowest possible level and thus absorb the surplus labour. His reply to the pessimists was, that it is only eleven years since the close of the great world war and only three years since the close of our own great national industrial stoppage, with its devastating consequences. The wonder was that the number of unemployed is not greater than it is. It should be remembered that we have actually got more people in employment to-day than we had twenty years ago. As a nation we had embarked upon a policy of high social taxation, higher education, a higher standard of living and shorter hours of labour. We were carrying a greater proportion of the war debt than any other nation, in addition to being the most heavily-taxed country in the world. It was a tremendous handicap and the only alternatives to defeat and disaster were greater efficiency, greater output per man and fewer men per shift.

In America the problem of paying high wages had been solved by this method. In Britain we had been trying to carry 4,000 mineworkers for every million tons of coal produced, and 40,000 miners and steel workers for every million tons of steel. These numbers could and would be drastically reduced. With the resultant increased volume of business more men would, of course, be required.

Cast Iron for Fuel Economisers.

At a meeting of the Institute of Fuel held in London on January 8, Mr. R. A. Chattock, in the chair, a Paper entitled "Fuel Economisers, with Special Reference to their Construction, Materials and Recent Developments," was read by MR. O. KUBALEK, in the course of which he said that it was a striking fact that during nearly 100 years of steam-power engineering the fuel economiser, originally invented in 1841, had retained its position as an important auxiliary to the boiler, while undergoing very little change in its design and practically none in its principle of operation.

Continuing, the author dealt with the efficiency of the various economisers and outlined the construction of that invented by Green, and said that the older forms of cast iron were unable to withstand repeated and violent shocks, although serious trouble occurred very seldom. Increasing boiler pressures actually had the effect of diminishing troubles from this source. It is a curious fact that an economiser which gave trouble from overheating at 150 lbs. pressure became perfectly satisfactory when used for 250 lbs. pressure under the same temperature conditions. In the case of the lower pressure, an outlet feed-water temperature of 350 deg. Fah. would probably lead to trouble if variations occurred in the rate of feeding or firing, whereas with the higher pressure the water could leave the economiser with perfect safety at a temperature of 375 deg. Fah.

The continued use of the older cast irons as constructional materials for economisers, although working pressures had increased greatly, was due partly to the fact that boiler-gas outlet temperatures had not until recent years increased correspondingly. This had led to a certain inefficiency in the last passes of the boiler, but it had, on the other hand, made accidental steam formation in the ordinary economiser quite impossible.

The author then dealt with the influence of high gas velocity on the rate of heat transfer in the economiser. The outstanding feature (continued the author) in which the modern economiser differs from the appliance which has held the field for many decades is the velocity of the gases over the heating surface. From the point of view of constant cleanliness of heating surface, the high gas velocity has a remarkable cleaning effect.

Gilled-Tube Economisers.

Recent years have seen considerable progress in the development of economisers with "extended surface" on the gas-swept side of the tubes. The principle of the gilled tube is perfectly sound, and is based on the fact that the rate of heat transfer between the gases and the metal of the tube is much less per sq. ft., etc., than the rate of absorption from metal to water. This is due partly to the more intimate contact between the metal and water on the inside of the tube and partly to the high resistance of the thin gas film adhering to the outer surface.

Cast Iron.

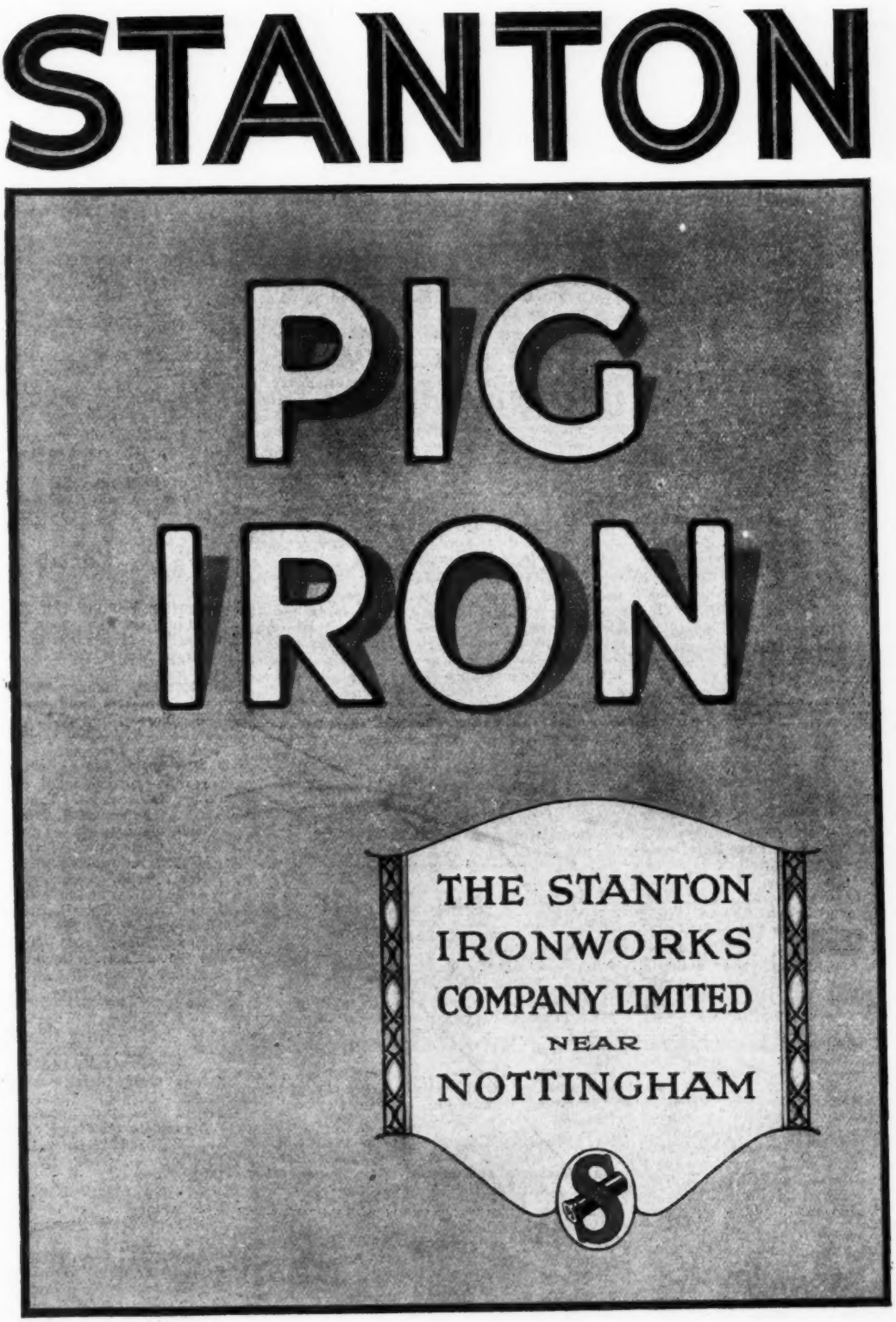
Turning now to a consideration of the materials used in economiser construction, cast iron is said to be the traditional material for economiser construction. The conditions under which an economiser is usually condemned to work are—from the point of view of wear and tear—as severe as any in the whole boiler plant. Both as regards internal and external corrosion, the metal of the economiser has to withstand the severest attacks with little attention and no protection beyond the original casting skin.

It is not too much to say that the cast-iron economiser owes its continued existence to the fact that the material of which it is constructed is capable of withstanding these severe attacks for lengthy periods of continuous operation. Where a steel-tube economiser is rapidly corroded externally, or severely pitted internally, a cast-iron tube is often entirely unaffected. The greater weight of cast iron is sometimes urged as a disadvantage, but in reality the extra quantity of material is an additional safeguard and guarantee of long life. Under moderate pressures, a cast-iron tube could waste away externally by an amount equal to the whole thickness of a steel tube and still have some years of useful life.

Modern cast iron is, however, a very different material from that used twenty years ago. The older Admiralty specifications were very moderate in their demands, and a tensile strength of 9 to 11 tons was all that was deemed necessary. To-day, metals are used which still retain all the corrosion-resisting properties of the older irons, and which have tensile strengths of 20 tons per sq. in. and upwards. The older cast irons were undoubtedly rather haphazard mixtures, in which little control was exercised as to the nature or proportion of the constituents. To-day these metals are precise metallurgical products, in which enhanced quality and improved service have resulted from accurately-controlled composition and structure.

It is interesting to note that old B.E.S.A. specifications for cast iron require that a bar 40 in. long, 2 in. by 1 in. in section, shall, when freely supported on a span of 36 in., have a central breaking load of not less than 28 cwts. and a deflection of 0.375 in. This test is still in general use, though the new standard bar 1.2 in. dia. has been adopted by the B.E.S.A. The standard economiser irons at present in use have a breaking load of 38 cwts. and a deflection of 0.46 in. This represents an increase of more than 35 per cent. breaking load, and of about 22 per cent. in deflection. The specified tensile breaking load of cast iron is 11 tons per sq. in. Standard economiser iron has an average tensile breaking load of 17 tons per sq. in.

With the newer standards, the progress is shown to the same extent. The standard specification for a bar 1.2 in. dia., centrally loaded on a span of 18 in., demands a breaking load of 2,000 lbs. and a centre deflection of 0.15 in. Standard economiser irons have a breaking load of 3,000 lbs. with a deflection of 0.32 in. The special grades of iron developed for higher pressures show even more prominently the progress in quality of this material.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Trade Talk.

A STEEL ROLLING-MILL, costing over £8,000,000, is to be erected by the American Steel Corporation near Gary, Indiana.

THE SECOND Sheffield Metallurgical Kindred Societies' Supper-Dance will be held on February 7, at the Royal Victoria Hotel.

THE NORTH BRITISH LOCOMOTIVE COMPANY, LIMITED, Glasgow, has secured from the Shanghai-Nanking Railway a contract for eight standard-gauge Pacific-type locomotives.

ALLOY WELDING PROCESSES, Ferry Lane Works, Forest Road, London, E.17, in their Bulletin No. 55, by examples, illustrate a hire system they have devised for renting their electric arc-welding apparatus.

AN INTERESTING CEREMONY took place at Rochester recently, when presentations were made by the chairman of Messrs. Aveling & Porter, Limited, to 16 men who had been in the firm's service for 50 years or more.

MESSRS. DORMAN, LONG & COMPANY, LIMITED, Middlesbrough, have received an order for 9,000 tons of steel sleepers for the Crown Agents for the Colonies. They are required for the railways of Uganda, Kenya and Tanganyika.

AT THE second monthly luncheon of the London Iron and Steel Exchange, held at the Great Eastern Hotel on Tuesday, January 14, at 1 p.m., a short address was presented by Mr. H. J. Skelton entitled "I Remember and I Foresee."

BEFORE a meeting of the Institution of Automobile Engineers, at the Royal Society of Arts, London, on Tuesday, January 7, Mr. T. W. Cooper read a Paper on "Roller Bearings," in which he dealt with crushing tests, compression, and creep.

THE RUMANIAN MINISTRY FOR PUBLIC WORKS is about to place orders for 5,000 tons of steel bridge-work. The four lowest tenders received were from German firms, including Krupps, the Silesian Laurahütte was fifth, and the Reshitza works of the Rumanian Railways the sixth.

SIR JOSIAH STAMP, addressing the Textile Institute at Bradford, on January 9, said that a study of the German accomplishment of rationalisation in the steel industry was full of meaning as to the imperative need for early action in several parallel industries in this country.

THE BLYTHSWOOD SHIPBUILDING COMPANY, LIMITED, Scotstoun, Glasgow, have received a contract to build a motor-propelled oil tanker of 11,500 tons deadweight for London owners. The propelling machinery will be supplied by Messrs. John G. Kincaid & Company, Limited, Greenock.

THE EMPLOYEES of the following firms have made contributions to infirmaries and other charitable institutions: — Messrs. Cruikshank & Company, Limited, Denny Iron & Steel Works, £150; New Grange Foundry Company, Limited, Bo'ness, £107; Messrs. William Baird & Company, Limited, £7,718.

MESSRS. ALEXANDER STEPHEN & SONS, LIMITED, Linthouse, Glasgow, have had under construction a passenger steamer for the Great Western Railway, which was scheduled to be launched on Tuesday, and will be an addition to the company's Channel fleets. The vessel is 290 ft. in length, and will be propelled by Parsons single-reduction geared turbines supplied with steam from four oil-fired boilers.

INTERNATIONAL COMBUSTION, LIMITED, Grinding and Pulverising Offices, is now known as Mining & Industrial Equipment, Limited. The address, 11, Southampton Row, W.C.1, remains the same, where the office accommodation has been considerably extended to cope with increasing business, 1929 having proved a record year for the sales of Hardinge mills, Raymond mills, Hum-mer screens and Rovac filters.

THE ACCIAIERIE VENETE, of Venice, has increased its capital from 1,000,000 lire to 30,000,000 lire, by issuing 290,000 new shares of 100 lire each, of which 150,000 shares will be assigned to the Società Cantieri Navali ed Acciaierie, of Venice, as the purchase price for its works. The Società Cantieri, of Venice, will increase on its part its share capital from 16,000,000 lire to 40,000,000 lire, by the issue of 192,000 new shares of 125 lire each.

THE AVERAGE net selling price of No. 3 Cleveland pig-iron for the quarter ended December 31 last has been certified at 68s. 2.71d. per ton, as compared with 65s. 5.92d. for the previous three months. Under the sliding-scale arrangements, the North-East Coast blastfurnacemen's wages are therefore advanced by 2.75 per cent. for the first quarter of the year, raising wages from 11.25 per cent. above the standard to 14 per cent. above the standard.

DURING THE YEAR 1929, 40 vessels arrived at the Prince of Wales Dock, Workington, with foreign iron ore for the United Steel Companies, Limited, and the total imports amounted to 161,000 tons—86,700 tons in the first six months and 74,300 tons in the second period of the year—compared with 115,000 tons in 1928. This is an increase of 45,670 tons. During the year four cargoes of steel rails, amounting to upwards of 18,000 tons, were shipped to South America.

SEVERAL ORDERS for new ships further improve shipbuilding prospects for the New Year. Messrs. Palmers Shipbuilding & Iron Company, Limited, Jarrow-on-Tyne, have secured a contract for two vessels for the Anglo-American Oil Company, and Messrs. Sir W. G. Armstrong, Whitworth & Company, Limited, Walker-on-Tyne, are to build two tankers for Scandinavian owners. Messrs. Harland & Wolff, Limited, have booked an order for a small steamer for Messrs. Andrew Weir & Company, to be built in Belfast. Messrs. Workman, Clark (1928), Limited, Belfast, have received an order for a large cargo steamer.

THE DISPOSALS COMMITTEE of the North-East Coast Exhibition, Newcastle, have accepted the tender of Messrs. Thos. W. Ward, Limited, Sheffield, for the Palaces of Engineering and Industry, and other buildings, stands and structures. There are about 20 large buildings, with floor space ranging from 176,000 down to 600 sq. ft., mostly constructed of steel and timber framing, with weather board and asbestos sheeting sides, wooden floors and ruberoid roofs. The grand stand in the Stadium is 150 ft. long and 50 ft. wide, and capable of seating about 3,000, and there are numerous large and small kiosks. It is expected that the buildings and structures will be dismantled for re-use and re-erection in other parts of the country.

IMPERIAL CHEMICAL INDUSTRIES, LIMITED, commenting on a suggestion that the chemical trade is depressed, state that their world trade for 1929 has been greater than ever before, and everything points to its continued expansion. With regard to the factories at Billingham, on the completion of the constructional programme at these works, the occupation which has been found thereon for a large number of men must necessarily cease. This step is inevitable in all constructional work, and is only striking at Billingham because of the magnitude of the new factories. They have every reason to expect that the production at the Billingham factories during the present year will show an increase over last year and that the number of men employed on production will be greater than the number so employed in 1929.

Obituary.

MR. A. E. OWEN, of Messrs. Rubery, Owen & Company, constructional engineers, Darlaston, died recently.

MR. THOMAS WHYMAN, managing director of Whyman's Foundry Company, Limited, Warrington, died on Tuesday, January 7.

MR. THOMAS HUGHES JACKSON, chairman of the Clay Cross Company, Limited, died at his residence at Claughton, Birkenhead, on Friday, January 3, in his 96th year.

MR. WILLIAM WATSON, proprietor of Messrs. William Watson & Company, Limited, iron and metal merchants and agents, 110, Cannon Street, London, E.C.4, died recently.

THE DEATH occurred, on January 6, at his home in Dennistoun, Glasgow, of Mr. William Hunter, who has been in the employ of the North British Locomotive Company, Limited, Springburn, for 54 years.

JOHN ROBERTSON, of Coatbridge, one of the four men who were burned whilst repairing a blast furnace at Summerlee Iron Works a week ago, has died in the Alexander Hospital from the effects of the injuries he received.

DR. SEBASTIAN ZIONI FERRANTI, F.R.S., the famous scientist and electrical engineer, died in Zurich on Monday, at the age of 65 years. He was president of the British Electrical Development Association, and in 1924 received the highest award of the Institution of Electrical Engineers—the Faraday Medal.

Personal.

MR. WILLIAM SIMONS, J.P., general manager of the Cardiff and Dowlais works of Messrs. Guest, Keen & Nettlefolds, Limited, has been elected a director of the company.

MR. F. RICH has retired after fifty years' service as accountant to the Coalbrookdale Iron Company, Shrewsbury. A presentation to him took the form of a cheque (subscribed by employees of all departments), accompanied by an illuminated address. Mr. W. S. Malcolm (formerly managing director) made the presentation, and commended the services of Mr. Rich under five managers.

MR. WILLIAM R. DONALD, manager of the Torry Foundry, South Esplanade West, Aberdeen, has been presented by the employees and friends with a beautiful polished mahogany Westminster chimes clock, on the occasion of his retirement after fifty years' service. Mr. G. Brown presided, and the presentation was made by Mr. P. Lamb, who spoke highly of the popularity and esteem in which Mr. Donald had been held by all during his long connection with the foundry and engineering trades. Mrs. Donald received a pair of silver vases, along with cordial good wishes to the worthy couple for long life and happiness.

Wills.

GAMBLE, B., of Messrs. Moss & Gamble Bros., Limited, steel manufacturers, Sheffield £20,423

WHITE, A. S., of Cowes, shipbuilder, a director of Messrs. W. White & Sons (Cowes), Limited £7,684

MARSH, JOSEPH, SEN., Pedmore, chairman of the Bradley Bar & Sheet Iron Company, Limited, Bilston £23,858

Contracts Open.

Hartley Wintney, Hants, January 24.—One mile of 4-in. cast-iron main, for the Rural District Council. Messrs. A. P. T. Cotterell & Son, 54, Victoria Street, Westminster. (Fee £3 3s., returnable.)

Liverpool, January 23.—Wrought-iron lamp standards, brackets, and cast-iron lamp columns and malleable cast-iron pitching irons, etc., for the Corporation. The City Lighting Engineer, 17, Highfield Street, Liverpool.

New Delhi, January 21.—Cast iron, mild steel or corrosion-resisting ingot iron, etc., for the Indian Stores Department. The Department of Overseas Trade. (Reference A.X. 8,971.)

Hull, January 22.—Two centrifugal pumps, etc., for the Corporation. Mr. T. Thomas, city engineer, (Fee £1, returnable.)

New Delhi, January 22.—Distribution piping, specials, valves and accessories, for the Indian Stores Department. The Department of Overseas Trade. (Reference A.X. 8,975.)

Slough, January 24.—Two centrifugal pumps, for the Urban District Council. Mr. A. Bromly, water engineer, William Street, Slough.

New Companies.

Non-Ferrous Metal Products, Limited, 95, Gresham Street, London, E.C.2.—Capital £10,000 in £1 shares.

Clydesdale Steel and Foundry Company, Limited, 81, Garngad Road, Glasgow.—Captial £5,000. Directors: G. Greig, H. Cowperthwaite and W. F. Reid.

E. Hind (South Bank), Limited, South Bank, Middlesbrough.—Capital £10,000. Metal merchants, etc. Permanent director and chairman: Mrs. E. Foster.

Associated Engineering Industries, Limited.—Capital £7,500. Permanent governing director: H. W. Johnson, "Ravenshoe," Cowley Hill Lane, St. Helens.

Titanium & Rare Metals, Limited, Panton House, 25, Haymarket, London, S.W.—Capital £7,500. Directors: Sir Percival E. Reynolds, Col. R. J. Blackham and R. Savage.

Consolidated Tin Smelters, Limited.—Capital £5,000,000 in £1 shares, to acquire the shares of the Eastern Smelting Company, Limited; Williams, Harvey & Company, Limited; the Cornish Tin Smelting Company, Limited; and the Penpoll Tin Smelting Company, Limited.

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TO BRITISH STEELFOUNDERS

THE SAFEGUARDING OF BRITISH STEEL FOUNDRY SAND against the competition of Foreign Sands produced under conditions entirely different from those at home, and free from the burdens and charges British Industry is carrying, is long overdue.

A QUESTION

Do British Steelfounders realise that every pound spent in British Sands tends to come back to them because it is spent in this country, but that every pound spent in Foreign Sands is not only lost to them but by affecting the rate of exchange against this country, tends to make food imports more costly?

A CHALLENGE

Our new Sand Milling and Mixing plants being now completed, we having equipped ourselves with Mechanical Excavators, Disintegrators, Loaders and such plant as will compare with any in the world; owning our own land, quarries and railway trucks, in a word, having equipped ourselves to the best of our knowledge and ability and in a manner we feel to be worthy of the reputation of

"YORKSHIRE SAND"

now offer to meet any foreign competition.

We offer to supply British Steel Foundry Sand

AS CHEAP AS ANY FOREIGN SAND OR CHEAPER
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AND we will give you instant delivery from one of four points.

☞ **In truck loads** (not asking for orders for 200 or 300 tons)

☞ **On Monthly Account**
(Not asking for cash against Bill of Lading)

WE KNOW YOU REALLY PREFER TO USE BRITISH SAND AND WE HERE AND NOW INVITE YOU TO ACCEPT OUR OFFER AND TO COMMUNICATE WITH US.

Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—Contrary to optimistic expectations of improved trade in the New Year, in the Cleveland iron trade conditions, so far, are disappointing, and, although there has been a little more inquiry, the volume of business transacted has been quite unimportant in extent of tonnage booked on forward account. Hopes are, however, entertained of an early expansion of demand on the part of Scottish consumers, who, for a long time past, have transferred their business to Midland furnaces, the latter having offered more favourable terms. As it is now confidently expected that the makers in question will shortly raise their prices more nearly approaching Cleveland quotations, it is regarded as probable that Middlesbrough iron will regain its old-time ascendency in the Scottish markets for foundry requirements. The export trade is still very limited, although the effect of a rise in Continental prices is reflected in bigger shipments from the Tees. But the local steelworks are still the biggest consumers of Cleveland iron, and the works managers seem determined to adhere to a policy of strict limitation of output in order that control of prices may not be imperilled. The Cleveland ironmasters are still firmly adhering to the policy of fixed minimum quotations, both to home consumers and for export, as follow:—No. 1 foundry iron, 75s.; No. 3 G.M.B., 72s. 6d.; No. 4 foundry iron, 71s. 6d.; No. 4 forge iron, 71s.

In the market for East-Coast hematite, makers have not yet disposed of stocks accumulated during the holiday break, and as a consequence buyers who are prepared to take prompt delivery can obtain parcels of East-Coast mixed numbers at 78s. 6d. per ton. But some big forward contracts have been booked, and makers are not prepared to accept orders for February-March delivery at less than 80s. per ton for mixed numbers or 80s. 6d. for No. 1 quality. On the North-West Coast, Bessemer mixed numbers are now firmly quoted at 78s. per ton at works.

LANCASHIRE.—The demand in this district for foundry pig continues in satisfactory volume, makers supplying the market reporting a fair aggregate tonnage on order on forward account. Quotations are very strong, with Derbyshire and Staffordshire No. 3 at 77s. per ton for delivery to local consumers, while for Scottish makes prices are firm at around 95s. per ton, also delivered.

THE MIDLANDS.—At Birmingham this week the market for foundry pig was fairly active, and the demand would justify additional furnaces going into blast if they could secure coke supplies at a reasonable rate and with a promise of continuity. There is still a stringency in connection with supplies from many of the furnaces, none of which has any stock of the usual foundry grades. Current prices are 75s. for No. 3 Northants and 78s. 6d. for Derbyshire and North Staffordshire No. 3, all per ton delivered local stations.

SCOTLAND.—Business in the markets for Scotch iron continues very quiet, and founders generally seem to be rather short of work. The basis price of 78s. for No. 3 Scotch foundry iron at the furnaces remains unaltered.

Finished Iron.

At Birmingham this week the market for this class of material continues unsatisfactory, apart from Staffordshire marked bars. These are quoted at £12 10s. at works, and the mills making this grade of iron continue to be very well occupied. There is little business developing for crown bars, and there is not nearly enough work to satisfy the needs of the few makers in this area. Prices vary from £10 to £10 10s., delivered this district, and the current price for nut and bolt iron is from £9 2s. 6d. to £9 7s. 6d. The foreign product is being offered quite freely at about £6 6s. delivered this area.

Steel.

The most active section in this week's Sheffield steel markets has developed in basic billets, which at the reduced quotation appear able to hold their own against the sharp foreign rivalry experienced of late. Siemens acid billets are a poor market, but it is stated that the output is about to be increased, which suggests that there is an improvement in the prospects for this class of steel. Quotations:—Basic billets, soft, £6 15s.; semi-hard, £7 12s. 6d.; medium hard, £8 2s. 6d.; hard, £9 2s. 6d. to £9 12s. 6d.; Siemens acid billets, £9 10s.; wire rods, soft basic, £8; medium hard, £9 15s. to £10; hard, £10 10s. to £11; acid wire rods, £12 5s. to £12 10s. In the tinplate market the tone continues steady, with quotations firm at 18s. 9d., coke quality, net cash, f.o.b. South Wales ports.

Scrap.

So far as concerns the markets for foundry scrap metal, little sign of activity has yet been observable, but deliveries are going forward more regularly, and a few contracts have been negotiated to cover the first quarter's requirements. In the Midlands there is a good demand for heavy cast-iron scrap, and prices are firm. For machinery cast-iron scrap in cupola sizes 70s. is the general price offered, for ordinary heavy metal 65s., and for light cast iron 60s. In Scotland business has not improved to any great extent, with prices of the leading lines of cast scrap unchanged, machinery quality being quoted at 70s., ordinary at 63s. 6d. and light material at 58s. to 60s., railway chairs making up to 67s., all per ton f.o.t. delivered consumers' works.

Metals.

Copper.—Speculative activity, backed by professional support, was responsible for a sharp advance last week in warrant copper values, which was maintained till the close on Wednesday. It is not, however, anticipated that the premiums now exacted will continue, as rough copper is not being attracted from the Continent, and this should have the effect of again depressing values.

Closing quotations are:—

Cash.—Thursday, £71 7s. 6d. to £71 10s.; Friday, £71 10s. to £71 12s. 6d.; Monday, £71 15s. to £71 17s. 6d.; Tuesday, £71 17s. 6d. to £72; Wednesday, £72 to £72 5s.

Three Months. — Thursday, £69 15s. to £69 16s. 3d.; Friday, £69 15s. to £69 17s. 6d.; Monday, £69 5s. to £69 7s. 6d.; Tuesday, £69 10s. to £69 12s. 6d.; Wednesday, £69 5s. to £69 7s. 6d.

Tin.—In the absence of definite information on the question of the restriction of the tin output, the market is still watching with anxiety for some portent of the future. Much interest was aroused last week by cabled news to the effect that 19 Malayan tin-mining companies, using about 30 dredgers, ceased work on the Sunday, in accordance with the recent recommendation of the Tin Producers' Association that work on that day should be suspended indefinitely. This announcement caused a sharp rally in the price of tin.

Official closing prices:—

Cash.—Thursday, £176 5s. to £176 7s. 6d.; Friday, £176 15s. to £177; Monday, £174 17s. 6d. to £175; Tuesday, £174 7s. 6d. to £174 12s. 6d.; Wednesday, £174 17s. 6d. to £175 2s. 6d.

Three Months. — Thursday, £179 15s. to £179 17s. 6d.; Friday, £180 to £180 5s.; Monday, £178 2s. 6d. to £178 5s.; Tuesday, £177 12s. 6d. to £177 17s. 6d.; Wednesday, £178 7s. 6d. to £178 12s. 6d.

Spelter.—In contrast to the high hopes which ushered in 1929, the spelter market is facing 1930 with a feeling of profound depression. The American returns show that there was a slight drop in the world output last year, and a loss in consumption, but to restore economic conditions to the market there must be some further restriction of smelting operations. In face of this fact, it seems all the more unfortunate that the Zinc Cartel should have come to such an ignominious end.

Daily quotations are:—

Ordinary. — Thursday, £19 10s.; Friday, £19 8s. 9d.; Monday, £19 7s. 6d.; Tuesday, £19 5s.; Wednesday, £19 5s.

Lead.—The market for soft foreign pig continues quiet and uneventful, and, with a fairly good consumptive demand, values remain steady, fluctuations being confined within the compass of very trifling amounts each week.

The week's prices have been:—

Soft Foreign (Prompt).—Thursday, £21 12s. 6d.; Friday, £21 12s. 6d.; Monday, £21 12s. 6d.; Tuesday, £21 12s. 6d.; Wednesday, £21 11s. 3d.

The Continental Steel Cartel.

The negotiations concerning the proposed prolongation of the Continental Steel Cartel have now reached the stage of considering details. How long the Cartel may remain in force is, of course, not known, but the Germans are said to desire a period of ten years, as in the case of their own national syndicates. With regard to the recent arrangement for the equalisation of export orders, the export organisation for the distribution of such orders, of which a number for bars have already been transferred by German and Luxemburg works to Belgian mills in need of work, will continue in operation for about six months until the proposed International Selling Syndicates are brought into operation. At the meeting of the Managing Committee, in Brussels on Monday, January 13, efforts were made to fix export quotas. The works will continue to apply for orders, while at the same time observing the agreed prices; the system will presumably continue until the establishment of the Selling Syndicates. The export organisation will occupy itself with the foreign business in semi-products, bars, joists, angles, hoops and plates, but for the time being medium and thin sheets are to be excluded owing to the large number of producers.

Students' Corner.

Q.—Can some examples be given of head feeding?

A.—One great point in the favour of head feeding, is that it cuts out the human element, and consequent possible errors, when handling the feeding rod. And no one will grumble about that, as an hour at a feeding rod on a hot day is very exhausting.

Vertical cast work, *id est,* moulds poured upon end are often fed by rod from the runner basin, which method, in most cases at the present time, is bad practice. The size and weight of feeding heads for vertically-poured castings depend chiefly on the type of casting and its weight. Dross heads must not be confused with feeding heads, although sometimes the head answers both purposes. For such castings as surface condensers, flange pipes, medium thickness sections of cylinders, rams and similar castings, the head is put on as a dross head, but with chubby thick section castings, with heavy brocketted flanges, such as marine steam cylinders, gas cylinders, hydraulic rams, cylinders and certain hydraulic pipes, rolls, etc., the heads are put on for feeding the casting. In some cases the feeding heads will reach a considerable weight, approaching a couple of tons, and may sometimes even exceed that.

Returning for a moment to heavy horizontally-poured castings, such as wheels, anvil and hammer blocks, standards, housings, etc., the weight and surface of these castings generally determine the size and number of feeders, their weight, size of feeding rods and length of time for feeding. No hard-and-fast rule can be enunciated. It often depends on circumstances, convenience and other matters.

IT IS ESTIMATED that the world's pig-iron production last year was 96 million tons and that of steel 118 million tons. These are record figures. Of these quantities Europe made 50.5 per cent. of the pig-iron make and 48.5 of the steel production. Great Britain has contributed to these totals 7½ million tons of pig-iron and 9.7 million tons of steel.

BEDWAS NAVIGATION FOUNDRY COKE

(Produced from the world-famous Bedwas Coking Coal.)

The British Benzol & Coal Distillation, Ltd., beg to announce that their new Woodall-Duckham Plant at Bedwas is now in operation.

Enquiries are invited from all those interested in high-grade Foundry and Furnace Coke.

S. INSTONE & CO., LTD.,
Sole World Sales Agents,
Baltic House, CARDIFF.

Agents for the Midlands :
J. C. ABBOTT & CO., LTD.,
Lloyds Bank Chambers,
New Street, BIRMINGHAM.

CAST IRON FLANGED PIPES

2 in.—12 in. & CONNECTIONS. to 24 in. dia.

WE HAVE FIFTY YEARS OF ACCUMULATED EXPERIENCE AND METAL PATTERNS.

JAMES & RONALD RITCHIE, LTD.,

Telephone : 52 & 53. MIDDLESBROUGH. Telegrams : "Ritchie, Middlesbrough."

NETHERTON IRON

AND

N.B I.C BARS

(SOUTH STAFFORDSHIRE MARKED BAR—LION BRAND).

IN ALL QUALITIES, GRADES, SIZES AND SECTIONS.

ALSO MADE INTO

CRANE CHAINS, SLINGS, FORGINGS, Etc.

N. HINGLEY & SONS, LTD.

NETHERTON IRONWORKS, DUDLEY.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	72	0	0
Three months	69	5	0
Electrolytic	83	5	0
Tough	76	10	0
Best selected	77	0	0
Sheets	110	0	0
India	90	10	0
Wire bars	84	0	0
Do. Jan.	84	0	0
Do. Feb.	84	0	0
Ingot bars	84	0	0
H.C. wire rods	86	2	6
Off. av. cash, December	68	7	3⅜
Do., 3 mths., December	67	15	10¾
Do., Sttlmnt., December	68	7	3
Do., Electro, December	83	3	6½
Do., B.S., December	75	16	4⅝
Do., wire bars, December	83	15	9
Aver. spot price, copper, Dec.	68	7	3⅜
Solid drawn tubes			15d.
Brazed tubes			15d.
Wire			11½d.

BRASS.

Solid drawn tubes	12½d.
Brazed tubes	14½d.
Rods, drawn	12½d.
Rods, extd. or rlld.	7½d.
Sheets to 10 w.g.	11½d.
Wire	10½d.
Rolled metal	10½d.
Yellow metal rods	7½d.
Do. 4 × 4 Squares	8d.
Do. 4 × 3 Sheets	8½d.

TIN.

	£	s.	d.
Standard cash	174	17	6
Three months	178	7	6
English	176	0	0
Bars	177	10	0
Straits	175	17	6
Australian	175	7	6
Eastern	180	5	0
Banca	182	7	6
Off. av. cash, December	179	10	2¼
Do., 3 mths, December	182	14	0
Do., Sttlmt., December	179	9	7½
Aver. spot, December	179	10	2¼

SPELTER.

	£	s.	d.
Ordinary	19	5	0
Remelted	18	0	0
Hard	16	10	0
Electro 99.9	21	7	6
English	19	15	0
India	18	0	0
Zinc dust (Nom.)	30	0	0
Zinc sales	6	0	0
Off. aver., December	20	7	5¼
Aver., spot, December	20	1	3¼

LEAD.

	£	s.	d.
Soft foreign ppt.	21	11	3
English	23	0	0
Off. average, December	21	9	6¾
Average spot, December	21	9	5¼

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	30	0	0
Do. V.M. ex-whf.	27	15	0
Rods	34	0	0
Boiler plates	26	10	0
Battery plates	27	0	0

ANTIMONY.

	£	s.	d.
Special brands, Eng.	48	15	0
Chinese	30	0	0
Crude	18	10	0

QUICKSILVER.

	£	s.	d.
Quicksilver	23	0	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

	£	s.	d.
Ferro-silicon—			
25%	7	17	6
45/50%	11	10	0
75%	19	0	0
Ferro-vanadium—			
35/50%	12/9 lb. Va.		
Ferro-molybdenum—			
70/75% c. free	4/2 lb. Mo.		
Ferro-titanium—			
23/25% carbonless	9d. lb.		
Ferro-phosphorus, 20/25%	£16	0	0
Ferro-tungsten—			
80/85%, c. fr.	3/1½ lb.		
Tungsten metal powder—			
98/99%	3/4½ lb.		
Ferro-chrome—			
2/4% car.	£30	0	0
4/6% car.	£23	2	6
6/8% car.	£21	17	6
8/10% car.	£21	15	0
Ferro-chrome—			
Max. 2% car.	£33	15	0
Max. 1% car.	£39	0	0
Max. 0.70% car.	£41	2	6
70% carbonless	11d. lb.		
Nickel—99% cubes, or pellets	£175	0	0
Ferro-cobalt	9/6 lb.		
Aluminium 98/99%	£95	0	0
Metallic chromium—			
96/98%	2/7 lb.		
Ferro-manganese (net)—			
76/80% loose	£12	10	0
76/80% packed	£13	10	0
76/80% export	£12	15	0
Metallic manganese—			
94/96%, carbonless	1/4 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

	£	s.	d.
Finished bars, 14% tungsten	£0	2	0
Finished bars, 18% tungsten	£0	2	9

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 7/32 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ¼ in. × ⅛ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

South Wales—	£	s.	d.		£	s.	d.
Heavy steel					3	7	6
Bundled steel and shrngs.	3	2	6	to 3	5	0	
Mixed iron and steel	3	2	6	to 3	3	6	
Heavy cast iron	2	17	6	to 2	18	6	
Good machinery for foundries					3	2	6
Cleveland—							
Heavy steel					3	3	6
Steel turnings					2	16	6
Cast-iron borings					2	13	0
Heavy forge					3	15	0
W.I. piling scrap					3	10	0
Cast-iron scrap	3	2	6	to 3	6	6	
Midlands—							
Ord. cast-iron scrap					3	5	0
Heavy wrought					3	17	6
Steel turnings	2	5	0	to 2	7	6	
Scotland—							
Heavy steel					3	9	0
Cast-iron borings					2	12	0
Wrought-iron piling					3	19	0
Heavy machinery					3	10	0

London—Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	61	0	0
Brass	43	0	0
Lead (less usual draft)	19	0	0
Tea lead	15	0	0
Zinc	13	0	0
New aluminium cuttings	65	0	0
Braziery copper	57	0	0
Gunmetal	54	0	0
Hollow pewter	132	0	0
Shaped black pewter	98	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	75/-
Foundry No. 3	72/6
Foundry No. 4	71/6
Forge No. 4	71/-
Hematite No. 1	79/-
Hematite M/Nos.	78/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	86/6
,, d/d Birm.	93/6
Midlands—	
Staffs. common*	—
,, No. 4 forge*	74/6
,, No. 3 fdry.*	78/6
Shrops. basic	—
,, Cold blast, ord.	—
,, ,, roll iron	—
Northants forge*	71/-
,, fdry. No. 3*	75/-
Derbyshire forge*	74/6
,, fdry. No. 3*	78/6
,, basic*	—

*d/d Black Country dist.

Scotland—	
Foundry No. 1	80/6
,, No. 3	78/-
Hem. M/Nos.	81/-
Sheffield (d/d district)—	
Derby forge	69/6
,, fdry. No. 3	73/6
Lincs. forge.	73/-
,, fdry No. 3	77/-
E.C. hematite	89/-
W.C. hematite	91/6
Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	—
,, fdry. No. 3	77/-
Northants foundry No. 3	—
Dalzell, No. 3 (special)	105/- to 107/6
Summerlee, No. 3	95/-
Glengarnock, No. 3	—
Gartsherrie, No. 3	95/-
Monkland, No. 3	95/-
Shotts, No. 3	95/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.) nom.					10	15	0
Nut and bolt iron	9	2	6	to 9	7	6	
Hoops					11	0	0
Marked bars (Staffs) f.o t.					12	10	0
Gas strip					11	0	0
Bolts and nuts, ¾ in. × 4 in.					15	5	0
Steel—							
Ship plates	8	15	0	to 8	17	6	
Boiler plts.	9	15	0	to 10	10	0	
Chequer plts.					10	12	6
Angles					8	7	6
Tees					9	7	6
Joists					8	10	0
Rounds and squares, 3 in. to 5½ in.					9	7	6
Rounds under 3 in. to ¾ in. (Untested)					8	2	6
						and upwards	
Flats—8 in. wide and over					8	12	6
,, under 8 in. and over 5 in.					8	17	6
Rails, heavy					8	10	0
Fishplates					12	10	0
Hoops (Staffs)					9	15	0
Black sheets, 24 g.					9	17	6
Galv.cor.shts., 24g.	12	5	0	to 12	10	0	
Galv. fencing wire, 8g. plain					12	0	0
Billets, soft	6	2	6	to 6	12	6	
Billets, hard	7	10	0	to 8	0	0	
Sheet bars	5	17	6	to 6	5	0	
Tin bars	5	17	6	to 6	5	0	

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1/4
Sheet to 10 w.g.	1/5
Wire	1/6
Rods	1/5
Tubes	1/9½
Castings	1/4

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	10d. to 1/4
Rolled—	
To 9 in. wide	1/4 to 1/10
To 12 in. wide	1/4½ to 1/10½
To 15 in. wide	1/4½ to 1/10½
To 18 in. wide	1/5 to 1/11
To 21 in. wide	1/5½ to 1/11½
To 25 in. wide	1/6 to 2/-
Ingots for spoons and forks	10d. to 1/6½
Ingots rolled to spoon size	1/1 to 1/9½
Wire round—	
3/0 to 10 G.	1/7½ to 2/2½

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2X foundry, Phila.	20.76
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic	20.26
Bessemer	20.76
Malleable	20.76
Grey forge	19.76
Ferro-mang. 80% d/d	105.00
O.-h. rails, h'y, at mill	43.00
Bessemer billets	35.00
O.-h. billets	35.00
O.-h. sheet bars	35.00
Wire rods	40.00
	Cents
Iron bars, Phila.	2.12
Steel bars	1.90
Tank plates	1.90
Beams, etc.	1.90
Skelp, grooved steel	1.85
Skelp, sheared steel	1.85
Steel hoops	2.20
Sheets, black, No. 24	2.75
Sheets, galv., No. 24	3.40
Sheets, blue an'l'd, No. 13	2.25
Wire nails	2.40
Plain wire	2.40
Barbed wire, galv.	3.05
Tinplates, 100-lb. box	$5.25

COKE (at ovens).

Welsh foundry	32/6 to 37/6
,, furnace	30/-
Durham and Northumberland—	
,, foundry	19/-
,, furnace	20/3
Midlands, foundry	—
,, furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 box	18/9
,,	28×20 ,,	37/6
,,	20×10 ,,	27/-
,,	18¾×14 ,,	19/6
C.W.	20×14 ,,	16/-
,,	28×20 ,,	34/6
,,	20×10 ,,	23/1½
,,	18¾×14 ,,	16/9
Terneplates	28×20	32/6 per box basis f.o.b.

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6	0	0	to	£7	10	0
Bars, hammered, basis	£17	10	0	to	£18	10	0
Bars and nail-rods, rolled, basis	£15	15	0	to	£16	15	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£32	0	0	to	£33	0	0
Faggot steel	£20	0	0	to	£24	0	0
Bars and rods dead soft, steel	£11	0	0	to	£14	0	0

All per English ton, f.o.b. Gothenburg.

TUBES AND FITTINGS.

Over ¼ in. up to 6 in.

	Tubes.	*Fittings.*
Gas	65%	47½%
Water	61¼%	42½%
Steam	57½%	37½%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.				£	s.	d.		
Jan.	9 ..	71	7	6	dec.	5/–	Jan. 9 ..	176	5	0	dec.	42/6
„	10 ..	71	10	0	inc.	2/6	„ 10 ..	176	15	0	inc.	10/–
„	13 ..	71	15	0	„	5/–	„ 13 ..	174	17	6	dec.	37/6
„	14 ..	71	17	6	„	2/6	„ 14 ..	174	7	6	„	10/–
„	15 ..	72	0	0	„	2/6	„ 15 ..	174	17	6	inc.	10/–

Electrolytic Copper.

		£	s.	d.				£	s.	d.		
Jan.	9 ..	83	5	0	No	change	Jan. 9 ..	176	15	0	dec.	50/–
„	10 ..	83	5	0	„	„	„ 10 ..	177	5	0	inc.	10/–
„	13 ..	83	5	0	„	„	„ 13 ..	176	0	0	dec.	25/–
„	14 ..	83	5	0	„	„	„ 14 ..	175	10	0	„	10/–
„	15 ..	83	5	0	„	„	„ 15 ..	176	0	0	inc.	10/–

Standard Tin (cash).

		£	s.	d.				£	s.	d.		
Jan.	9 ..	176	5	0	dec.	42/6	Jan. 9 ..	30	0	0	No	change
„	10 ..	176	15	0	inc.	10/–	„ 10 ..	30	0	0	„	„
„	13 ..	174	17	6	dec.	37/6	„ 13 ..	30	0	0	„	„
„	14 ..	174	7	6	„	10/–	„ 14 ..	30	0	0	„	„
„	15 ..	174	17	6	inc.	10/–	„ 15 ..	30	0	0	„	„

Tin (English ingots).

		£	s.	d.				£	s.	d.		
Jan.	9 ..	176	15	0	dec.	50/–	Jan. 9 ..	19	10	0	dec.	5/–
„	10 ..	177	5	0	inc.	10/–	„ 10 ..	19	8	9	„	1/3
„	13 ..	176	0	0	dec.	25/–	„ 13 ..	19	7	6	„	1/3
„	14 ..	175	10	0	„	10/–	„ 14 ..	19	5	0	„	2/6
„	15 ..	176	0	0	inc.	10/–	„ 15 ..	19	5	0	No	change

Zinc Sheets (English).

		£	s.	d.				£	s.	d.		
Jan.	9 ..	30	0	0	No	change	Jan. 9 ..	23	0	0	No	change
„	10 ..	30	0	0	„	„	„ 10 ..	23	0	0	„	„
„	13 ..	30	0	0	„	„	„ 13 ..	23	0	0	„	„
„	14 ..	30	0	0	„	„	„ 14 ..	23	0	0	„	„
„	15 ..	30	0	0	„	„	„ 15 ..	23	0	0	„	„

Spelter (ordinary).

		£	s.	d.		
Jan.	9 ..	19	10	0	dec.	5/–
„	10 ..	19	8	9	„	1/3
„	13 ..	19	7	6	„	1/3
„	14 ..	19	5	0	„	2/6
„	15 ..	19	5	0	No	change

Lead (English).

		£	s.	d.		
Jan.	9 ..	23	0	0	No	change
„	10 ..	23	0	0	„	„
„	13 ..	23	0	0	„	„
„	14 ..	23	0	0	„	„
„	15 ..	23	0	0	„	„

Exports of Iron Castings in December and the twelve months 1929, compared with December and the twelve months 1928.

——	December, 1928.	December, 1929.	Twelve months, 1928.	Twelve months, 1929.	December, 1928.	December, 1929.	Twelve months, 1928.	Twelve months, 1929.
	Tons.	Tons.	Tons.	Tons.	£	£	£	£
BUILDERS' CASTINGS—								
Stoves, grates, etc., cisterns, baths, etc., and cooking and washing boilers—								
To Argentine Republic	121	250	1,812	2,066	4,185	12,901	72,971	94,210
„ British South Africa	539	242	3,834	3,558	17,544	8,483	132,625	128,050
„ „ India	224	190	1,587	1,759	9,063	7,096	66,973	70,260
„ Australia	57	78	632	775	3,849	4,966	43,828	45,677
„ New Zealand	207	148	1,889	1,471	9,098	8,096	97,406	88,915
„ Other Countries	1,265	1,116	9,928	10,893	58,352	51,483	462,942	501,162
Total	2,413	2,024	19,682	20,522	102,091	93,025	876,745	928,274
PIPES AND FITTINGS—CAST—								
To Argentine Republic	831	1,384	9,665	24,222	7,851	13,754	95,672	227,644
„ British South Africa	1,094	1,955	6,018	9,362	12,161	17,531	82,617	108,458
„ „ India	394	348	7,570	4,250	5,665	4,982	102,979	58,589
„ Straits Settlements and Malay States	3,245	870	19,130	19,925	29,212	8,454	171,077	151,541
„ Ceylon	1,036	142	3,545	2,203	9,224	1,681	33,824	22,387
„ Australia	489	350	10,369	3,828	5,332	4,173	107,588	45,328
„ Other Countries	4,961	5,970	57,892	72,317	56,039	67,161	727,905	841,255
Total	12,050	11,019	114,189	136,107	125,484	117,736	1,321,662	1,455,202
HOLLOW-WARE—								
Cast, not Enamelled, and Cast, Tinned	513	477	5,016	5,010	18,449	14,300	184,596	175,556
„ Enamelled	48	57	782	941	5,070	5,858	75,226	84,984
CASTINGS, in the rough—								
Iron	110	207	1,569	1,603	3,095	5,774	50,166	57,174
Steel	80	129	771	1,504	3,143	4,456	32,827	58,934

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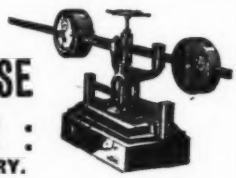

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